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### (54) Disc reproducing apparatus

(57) A disc reproducing apparatus comprises a disc holder (300) for receiving a plurality of discs, a disc transporting (100) means for transporting a disc inserted from outside into the disc holder, and a disc reproducing means (200) for reproducing a disc selected from the plurality of discs received in the disc holder. The disc holder includes a plurality of trays each for mounting one disc, guide means allowing the trays to move only in tray arranging direction, a fixed bottom plate (302b) for supporting the plurality of trays, a movable top plate (302a) movable only in the tray arranging direction by virtue of the guide means. Further, the movable top plate is urged towards the fixed bottom plate by virtue of urging means (303).

FIG.1

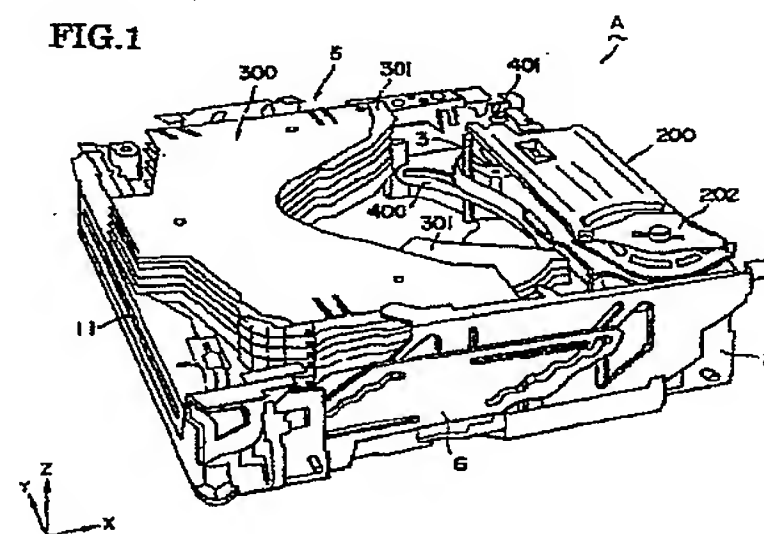
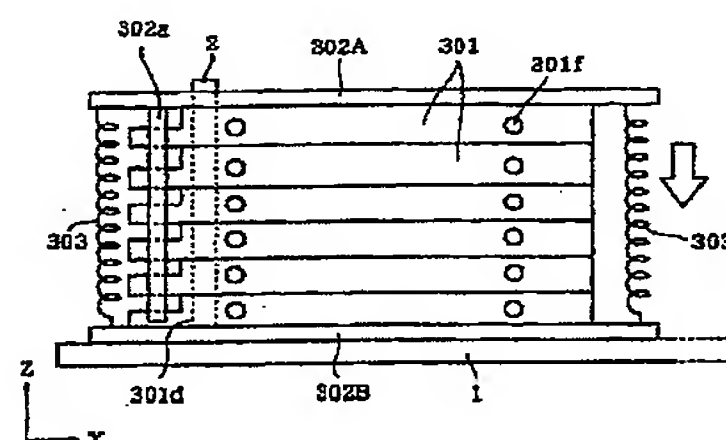


FIG.7



EP 1 005 039 A1

## Description

### BACKGROUND OF THE INVENTION

[0001] The present invention relates to a disc reproducing apparatus.

[0002] In general, a compact disc (hereinafter referred to as disc) has a diameter of 12 cm and a thickness of 1.2 mm. The information recorded on the disc is reproduced continuously from its inner circumferential area to its outer circumferential area.

[0003] There have been known several types of disc reproducing apparatus which can accommodate a plurality of discs, and can select one disc therefrom so as to reproduce the same. One type of disc reproducing apparatus has a structure in which a detachable magazine accommodating a plurality of discs is at first installed into the apparatus, and one disc is then selected therefrom when it is to be reproduced.

[0004] Recently, an improved type of disc reproducing apparatus has been disclosed by Japanese Unexamined Patent Application No. 8-21186, which is so fabricated that a magazine accommodating a plurality of discs (with each disc surface arranged in a horizontal position) may be moved in the vertical direction in order that one disc may be selected therefrom so as to be reproduced. In detail, the disc magazine is moved as a whole so that a selected disc is raised to a correct height at which a disc reproducing means stays. After that, the selected disc is moved horizontally into the disc reproducing means so as to be reproduced.

[0005] However, with the above disc reproducing device, when a desired disc is to be selected from a plurality of discs, the disc magazine as a whole has to be moved in the vertical direction. This, however, requires a considerable driving force and hence a considerable load will be exerted on a transporting mechanism for transporting the entire disc magazine carrying all these discs.

[0006] Further, since the disc magazine has to be moved in the vertical direction to cause the selected disc to arrive at a correct height at which the disc reproducing means stays, various elements forming the transporting mechanism has to be prepared and assembled together with an extremely high precision, hence making it difficult to reduce a cost for manufacturing the disc reproducing apparatus. Moreover, even if the various elements forming the transporting mechanism are prepared and assembled properly with a high precision, it will still be occasionally difficult to enable a selected disc to arrive at exactly the correct height with respect to a disc reproducing means.

### SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide an improved disc reproducing apparatus which is allowed to reduce a load exerted on a transporting

mechanism, and can enable a selected disc to move to a correct height with respect to a reproducing means, thereby solving the above-mentioned problems peculiar to the above-discussed prior art.

[0008] According to the present invention, there is provided a disc reproducing apparatus which comprises a disc holder for receiving a plurality of discs, a disc transporting means for transporting a disc inserted from outside into the disc holder, and a disc reproducing means for reproducing a disc selected from the plurality of discs received in the disc holder. The disc holder includes a plurality of trays each for mounting one disc, guide means allowing the trays to move only in tray arranging direction, a fixed bottom plate for supporting the plurality of trays, a movable top plate movable only in the tray arranging direction by virtue of the guide means. Further, the movable top plate is urged towards the fixed bottom plate by virtue of urging means.

[0009] In one aspect of the present invention, said apparatus includes tray holding means for holding a tray selected from the plurality of the trays, and moving means for moving the tray holding means to a predetermined height in the tray arranging direction. In particular, the predetermined height is a height for completing a desired disc transportation by using the disc transporting means, or a height for reproducing a selected disc by using the disc reproducing means.

[0010] In another aspect of the present invention, the tray holding means and the disc reproducing means are integrally moved in the tray arranging direction by virtue of the moving means.

[0011] In a further aspect of the present invention, said apparatus further includes a tray pressing means movable between a contact position for contacting the trays and a non-contact position separated from the trays.

[0012] In a still further aspect of the present invention, when any one tray is selected from the plurality of the trays, the tray pressing means will get in contact with one or more trays located below the selected tray.

[0013] In one more aspect of the present invention, the urging means is comprised of spring members provided between the movable top plate and a fixed bottom plate, with the fixed bottom plate secured on the main chassis of the disc reproducing apparatus.

[0014] The above objects and features of the present invention will become better understood from the following description with reference to the accompanying drawings.

### BRIEF DESCRIPTION OF DRAWINGS

[0015]

Fig. 1 is a perspective view indicating the disc reproducing apparatus made according to the present invention.

Fig. 2 is an explanatory view indicating some impor-

tant portions of the disc reproducing apparatus.

Fig. 3 is a perspective view indicating the disc reproducing apparatus of the present invention, with some portions thereof omitted for an easy description of the apparatus.

Fig. 4A is a front view of the disc reproducing apparatus.

Figs. 4B and 4C are sectional views indicating part of the apparatus of Fig. 4A.

Fig. 5 is a bottom plane view indicating part of a disc transporting mechanism used in the disc reproducing apparatus.

Fig. 6 is a plane view indicating a disc holder of the disc reproducing apparatus.

Fig. 7 is a side view indicating the disc holder of Fig. 6.

Fig. 8 is a plane view indicating a relationship between the disc transporting mechanism and the disc holder.

Fig. 9 is a plane view indicating a relationship between the disc transporting mechanism and the disc holder.

Fig. 10 is an exploded perspective view indicating the disc reproducing apparatus of the present invention.

Fig. 11 is a bottom view of the apparatus of Fig. 10.

Fig. 12 is a side view of the apparatus of Fig. 10.

Fig. 13 is an explanatory view indicating a wedge member used in the disc reproducing apparatus of the present invention.

Fig. 14A is a plane view indicating a disc reproducing section of the apparatus of the present invention.

Fig. 14B is an explanatory view indicating a part of the disc reproducing section.

Fig. 15A is an explanatory view indicating a clamping action of the disc reproducing section.

Figs. 15B and 15C are views indicating part of the action shown in Fig. 15A.

Fig. 16 is a plane view indicating a pivoting movement of the disc reproducing section.

Fig. 17 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Fig. 18 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Fig. 19 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Fig. 20 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Fig. 21 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Fig. 22 is an explanatory view indicating an operation of the disc reproducing apparatus of the

present invention.

Fig. 23 is an explanatory view indicating an operation of the disc reproducing apparatus of the present invention.

Figs. 24A, 24B and 24C are side views indicating a relationship between a tray pressing member and the disc holder in the disc reproducing apparatus of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0016]** Referring to Fig. 1, a disc reproducing apparatus A of the present invention has a chassis 1 which is formed with an elongated opening 11 on the front side thereof, so that a disc may be inserted into or removed from the reproducing apparatus A.

**[0017]** Referring to Fig. 2, a pair of disc driving rollers 101 are provided within the reproducing apparatus A, located near both ends of the elongated opening 11. Each of the disc driving rollers 101 is arranged horizontally in parallel with the disc transporting direction, and is rotatable in either direction so as to assist a disc in its movement into and from the apparatus A. Further, each roller 101 is allowed to make a semi-circular turning about a support post 104 (Fig. 3). In addition, the surface of each roller 104 is formed into a tapered shape being gradually sharpened towards the center line of the disc movement, in order that a disc being transported is sure to be moved along the center line.

**[0018]** Referring again to Fig. 1, the reproducing apparatus A has a disc holder 300 provided close to the front side of the apparatus. The disc holder 300 has a plurality of trays 301 arranged in a direction Z, with each tray 301 being able to hold one disc.

**[0019]** Further referring to Fig. 1, a disc reproducing section 200 is provided within the reproducing apparatus A close to the rear side thereof. A pair of slide plates 5 and 6 are provided left and right on the outsides of the main chassis 1 in a manner such that they are movable back and forth in a direction X. A movable chassis 400 (Figs. 1 and 3) is provided to be movable vertically by virtue of a driving force from the slide plates 5 and 6. In fact, the reproducing section 200 is mounted on the movable chassis 400 so that it is horizontally pivotable about a support shaft 401 (Figs. 1 and 3) by moving a movable pin 3.

**[0020]** Referring to Fig. 2, the reproducing section 200 comprises a turntable 201 for mounting an optical disc, an optical pickup 203 for reproducing the information recorded on the disc, a pickup moving device 204 for slidably moving the pickup 203 in the radial direction of the disc, a switching member 12 and a detecting switch 13 which are capable of detecting an innermost circumferential position in order that the pickup 203 can exactly stop at the innermost circumferential position of the disc, and are also capable of detecting the loading of a disc in a predetermined position.



**[0021]** Further, the reproducing section 200 includes a clamber 202, one end of which is pivotably supported on the disc reproducing section 200, and the other end of which is made capable of downwardly pressing a disc so as to clamp it at a predetermined position.

**[0022]** As shown in Fig. 2, photo-sensors 14a and 14b are provided in the vicinity of the elongated opening 11 to detect the movement of the discs. In detail, the photo-sensor 14a is located at a position slightly away from the underside of a loaded disc, the photo-sensor 14b is located at a position slightly away from the underside of the disc holder 300, but just on the underside of the loaded disc. Further, a photo-sensor switch 14c is located in the vicinity of one driving roller 101. With the use of the photo-sensor 14a and the photo-sensor switch 14c, it is allowed to detect whether a disc is a 12-cm disc or a 8-cm disc.

**[0023]** Referring again to Fig. 2, reference numeral 207 is used to represent a clamping means which can move a clamber base 205 by virtue of the movement of the movable pin 3 and can press the clamber 202 so as to effect a downward pivoting movement thereof. In detail, the clamping means 207 is connected through a coil spring 208 to the clamber base 205 which is in fact a main body of the clamber 202.

**[0024]** Referring to Fig. 3, the main chassis 1 is used to support the disc transporting mechanism 100 including the pair of disc driving rollers 101, the disc reproducing section 200, the disc holder 300, and a tray moving mechanism for moving the trays 301.

**[0025]** As shown in Fig. 4, the disc transporting mechanism 100 is used to move a disc (inserted inwardly through the elongated opening 11) to the disc holder 300, and to move a disc from the disc holder 300 to the outside of the reproducing apparatus A so as to discharge said disc.

**[0026]** A disc inserted through the elongated opening 11 into a disc transport passage 102, gets in contact with the pair of driving rollers 101 arranged in parallel to a direction Y and positioned under the disc transport passage 102, thereby enabling the disc to be transported in a direction X.

**[0027]** Further, the pair of driving rollers 101 are freely pivotably supported by a pair of support chassis 103 (Figs. 4A and 5). The two support chassis 103 are in turn pivotable about the support posts 104 by virtue of a roller moving mechanism which will be described in detail later.

**[0028]** As shown in Fig. 5, each driving roller 101 is provided at one end thereof with a gear 101a which is coaxial with the roller 101. Each support chassis 103 has a pair of upright plates 103a (Figs. 4A and 5) and is provided under the driving roller 101, so that both ends of each driving roller 101 may be rotatably supported by the pair of the upright plates 103a.

**[0029]** As shown in Fig. 4A, a pair of disc passage restriction members 106 are provided above the pair of

driving rollers 101, and are supported so that each restriction member 106 is freely pivotable about a fulcrum 103b. In this way, a narrow space formed between the restriction members 106 and the driving rollers 101 may be used as a disc transport passage. Further, coil springs 107 are provided between restriction members 106 and support chassis 103, so that the restriction members 106 are urged towards the driving rollers 101.

**[0030]** As shown in Figs. 4A to AC, a pair of pivoting members 105 are provided on both ends of the main chassis 1, with each being pivotable about a shaft 104. One end of each pivoting member 105 is pivotably supported on the main chassis 1 and the other end thereof is pivotably supported by a support chassis 103. In fact, each pivotal member 105 is partially inserted in a hole (not shown) formed on the support chassis 103. A gear portion 105c (Figs. 4A and 5) is formed on the upper end of each pivoting member 105, and is engaged with a corresponding gear portion 101a coaxial with a driving roller 101.

**[0031]** Referring again to Fig. 4A, one of the two pivoting members 105 has a driving force transmitting pulley 105a, so that a driving force from a motor 108 (Fig. 8) may be transmitted hereto through a belt 109 (Fig. 8). Further, another sort of pulley 105b is provided on the lower side of each pivoting member 105. In this way, the pair of the pivoting members 105 are allowed to be driven in synchronism with one another. Therefore, with the use of such a structure, a driving force from single one motor may be smoothly transmitted to the two driving rollers 101.

**[0032]** Fig. 4B is used to illustrate one example of the internal structure of a pivoting member 105. As shown in Fig. 4B, the outer surface of a support shaft 104 provided upright on the main chassis 1 is in slidable contact with the inner surface of the pivoting member 105. Fig 4C is used to illustrate another example of the internal structure of a pivoting member 105. As shown in Fig. 4C, two annular projections 104a are formed upper and down on the support shaft 104, so as to get sliding contact with the inner surface of the pivoting member 105. A middle portion 104b between the two annular projections 104a has a smaller diameter than the annular projections 104a, and an amount of grease is allowed to be introduced into an annular space formed between the middle portion 104b and the inner surface of the pivoting member 105. In this way, it is sure to reduce an undesired friction resistance occurring within the pivoting member 105.

**[0033]** Further, each support chassis 103 has a downwardly projected member 103c, as shown in Fig. 4A. A movable member having a flat U-shape section (Fig. 4A) is provided on the main chassis 1, which is movable in a direction X. In detail, the movable member 110 is engaged with two downwardly projected members 103c. With the use of such arrangement, when the movable member 110 is moved in a direction X, each support chassis 103 will pivot about a shaft 104, and

each driving roller 101 will also pivot about a shaft 104. At this moment, the gear 101a of the driving roller 101 is in engagement with the gear 105c of the pivoting member 105 (Fig. 5).

[0034] Referring to Figs. 6 to 9, the disc holder 300 has a plurality of trays 301 arranged in a direction Z. Two guide rod 2 are provided upright on the main chassis 1. Each tray 301 is formed with two through holes 301d through which the two guide rods 2 are inserted so as to ensure that the trays 301 can move only in a direction Z (Fig. 7).

[0035] Fig. 6 is a plane view mainly showing the trays 301 of the disc holder 300. As shown in Fig. 6, each tray 301 has a generally V-shaped holding section 301a formed with one notch 301b and two notches 301c. The notch 301b has an area capable of covering the center of a disc when the disc is held thereon, thereby allowing the entering thereinto of the turntable 201, damper 202 and the pickup 203 of the reproducing section 200.

[0036] The two notches 301c are formed right and left on the front side of the tray 301, thereby allowing the entering of the two driving rollers 101.

[0037] In Fig. 6, reference numerals 301d are used to represent two through holes for the guide rods 2 to insert therethrough. Reference numerals 301e are used to represent two pressing means which can press the outer edge of a disc and thus fix the disc in a predetermined position by virtue of an elastic member (not shown).

[0038] Further, there are provided two projections 301f on both sides of each tray 301. Each projection 301f is adapted to receive a driving force from a wedge member 410 (Fig. 10). Moreover, there is provided (on the main chassis 1) a tray pressing means 304 for pressing against the edge of each tray 301. The tray pressing means 304 has two guide grooves 304a and 304b. Each of the two guide grooves 304a, 304b is allowed to be engaged by an engaging pin (not shown) protruding upwardly from the main chassis 1. When a disc is inserted into or removed from the disc holder 300, such engaging pins may be driven by a driving member (not shown) so as to move back and forth with respect to an edge portion of each tray 301. An engaging member 304c is provided at one end of the pressing means 304, forming an upright plate (Fig. 24) having a height suitable for transporting a tray, and capable of engaging with or disengaging from an edge portion of each tray.

[0039] Fig. 7 is a side elevation indicating the disc holder 300. As shown in Fig. 7, the disc holder 300 has six trays 301 arranged one upon another in a direction Z, with each tray 301 having two through holes 301d. The guide rods 2 are inserted through all these through holes 301d so that the six trays 301 may be desirably fixed in position. Further, a restriction plate 302A is provided on the top of the six trays 301, another restriction plate 302B is provided under the lowermost tray 301 on

the main chassis 1. In this way, the six trays 301 may be restricted between the two restriction plates 302A and 302B. Moreover, each of the restriction plates 302A and 302B has two through holes into which the two guide rods 2 may be inserted so that the two restriction plates 302A and 302B can be properly fixed in position.

[0040] In detail, the restriction plate 302B is fixed on the main chassis 1. A plurality of coil springs 303 are provided at several positions between the two restriction plates 302A and 302B, so that the two restriction plates 302A and 302B are urged towards each other (shown by an arrow in Fig. 7) by virtue of the spring force of the coil springs 303. In addition, a plurality of downwardly extending elongate members 302 are provided to engage against the side faces of the six trays, so that the trays 301 may be prevented from an undesired movement in either a direction X or a direction Y.

[0041] With the use of the above arrangement, the six trays 301 may be at first interposed between the two restriction plates 302A and 302B, and coil springs 303 may then be attached in their predetermined positions, followed by insertion of the guide rods 2 through the holes 301d formed in all the trays 301 and the restriction plates 302A, 302B. Finally, the lower restriction plates 302B is fixed on to the main chassis 1, thereby completing the assembling operation of the six trays 301.

[0042] Here, with the use of the driving roller moving mechanism and with the use of the notches 301c of the trays 301, the pair of driving rollers 101, 101 are allowed to pivot between their projected positions (for transporting a disc, shown in Fig. 8) and their retracted positions (not for transporting a disc, shown in Fig. 9).

[0043] As shown in Fig. 8, when a disc is being transported, the pair of driving rollers 101 are caused to project into the notches 301c of a tray 301. At this moment, the two driving rollers 101, 101 are generally in parallel with the elongated opening 11, and its driving force is caused to act in the direction X (disc transporting direction). In this way, the two driving rollers 101, 101 are in the same area as occupied by the disc, so that a possible movement of the disc in the direction Z may be prevented. At this time, the tray pressing means 304 is in engagement with the edge of the tray 301.

[0044] As shown in Fig. 9, when a disc is not being transported, the pair of driving rollers 101 are caused to retract from the notches 301c of the tray 301. At this moment, the two driving rollers 101, 101 are generally not in parallel with the elongated opening 11, and are not in the same area as occupied by the disc.

[0045] In fact, a disc is reproduced under a condition shown in Fig. 9, so that it may be reproduced in a predetermined manner without being hampered by the driving rollers 101. Further, under a condition shown in Fig. 9, since the tray pressing means 304 is allowed to slide along the guide grooves 304a and 304b, the tray pressing member 304 will get engaged with the edge of the tray 301, thereby preventing any undesired vibration of the tray 301.



[0046] Referring to Fig. 10, the movable chassis 400 includes a flat-plate 400a mounting the disc reproducing section 200, and a pair of side plates 400b provided on both sides of the flat-plate 400a. Each side plate 400b is provided with two pivotable wedge members 410 which are simultaneously pivotable by virtue of a driving mechanism (not shown). Therefore, there are four wedge members in all which, together with the driving mechanism, forms a tray holding mechanism.

[0047] Fig. 11 and Fig. 12 are used to indicate a moving mechanism for moving the movable chassis 400.

[0048] Fig. 11 is a plain view indicating the main chassis 1. As shown in Fig. 11, a pivoting arm 4 is freely pivotably installed on the inner surface of the bottom of the main chassis 1, with a fulcrum 4a serving as a pivot center. The pivoting arm 4 is driven by a driving force from a motor (not shown). Further, the main chassis 1 has four upright plates 1a provided on left and right sides of the chassis (Fig. 10). Sliding plates 5 and 6 are provided to be able to move along the upright plates 1a in the direction X (Figs. 10 and 11). Further, the slide plates 5 and 6 are provided with small plates 5a and 6a protruding in the direction Y (Fig. 11). The small plates 5a and 6a are pivotably connected with the both ends of the pivoting arm 4. In this way, when the pivoting arm 4 is driven by a driving force from a motor (not shown), the slide plates 5 and 6 will be caused to move in mutually opposite directions (but all in the direction X shown in Figs. 10 and 11).

[0049] Fig. 12 is a side view illustrating the slide plate 6. As shown in Fig. 12, the slide plate 6 has two elongated holes 6b arranged in the direction X, each of which is engaged by a pin 1c formed on each upright plate 1a on the right side (Fig. 10). In this way, the sliding movement of the plate 6 in the direction X may be properly restricted.

[0050] Referring again to Fig. 10, each upright plate 1a has an elongated guide groove 1b, so that there are four elongated grooves 1b in all since there are four upright plates 1a. On the other hand, the movable chassis 400 has a pair of side plates 400b each having two fixed pins 400c. By engaging the pins 400c in the elongate guide grooves 1b, it is allowed to properly restrict the movement of the movable chassis 400 in the direction Z. Further, the two pins 400c of the right side plate 400b are also engaged in two inclined stairway-like elongated holes 6c formed on the slide plate 6. Accordingly, when the slide plate 6 is moved in the direction X, the pins 400c will be forced to move in the direction Z. Similarly, the two pins 400c of the left side plate 400b are also engaged in two inclined stairway-like elongated holes 5c formed on the slide plate 5 (Fig. 10). In this way, when the pair of the slide plates 5 and 6 are moved in the direction X, the four pins 400c will be caused to move in the direction Z, thereby causing the movable chassis 400 to move in the vertical direction (the direction Z).

[0051] Fig. 13 is used to illustrate one of the wedge members 410 pivotably attached on the side plates 400b of the movable chassis 400. In Fig. 13, reference numeral 410a is a pivotal fulcrum, reference number 410b is a projection adapted to slidably engage into one of arc-shaped grooves 400d formed on each side plate 400b. By virtue of the slidable engagement of the arc-shaped grooves 400d with the projections 410b, the pivoting movement of the wedge members 410 may be properly restricted.

[0052] In Fig. 13, reference numeral 410c is a generally L-shaped groove formed on each wedge member 410, while reference numerals 410d, 410e, 410f, 410g are all cam surfaces engageable with the projections 301f of the disc trays 301. As related in the above, the four wedge members 410 are pivotable at the same time by virtue of an interlock mechanism (not shown).

[0053] The disc reproducing section 200 will be described in the following, with reference to Figs. 14 to 16.

[0054] Referring to Fig. 14, the disc reproducing section 200 is provided on the movable chassis 400 which is movable in the direction Z by virtue of the above-described mechanism. Thus, the disc reproducing section 200 is also movable in the direction Z. Further, the disc reproducing section 200 is pivotable about a shaft 401 erected on the movable chassis 400, so that the reproducing section 200 is allowed to pivot between a reproducing position and a non-reproducing position by virtue of a mechanism (which will be described later).

[0055] As shown in Fig. 14A and Fig. 15A, a turntable 201, an optical pickup 203 and a pickup moving mechanism 204 are provided on the base 200a of the reproducing section 200. The base 200a is supported on the movable chassis 400 and is freely pivotable about the shaft 401. A damper base 205 is provided on the above base 200a, and is freely pivotable (in the direction Z) about a pivot shaft 200b (Fig. 15A). A clumper 202 is held at the front end of the clumper base 205.

[0056] Further, as shown in Fig. 14B and Fig. 15A, the clumper base 205 has a converged portion 205a. Moreover, the pivot shaft 200b is provided with a spring 206. The spring 206 is used to produce an urging force to cause the clumper base 205 to be urged towards the base 200a of the reproducing section 200. With the use of such a spring 206, it is sure to obtain a clamping force for clamping a disc in a predetermined position.

[0057] Referring to Fig. 14A and Figs. 15A - 15C, a clumper effecting member 207 is provided on the base 200a of the reproducing section 200. As shown in Fig. 16, the clumper effecting member 207 has two elongated holes 207a. The elongated holes 207a are engaged by the pins 200c erected on the base 200a. In this way, the clumper effecting member 207 is allowed to move in the axial direction of the pivot shaft 200b. Further, the clumper effecting member 207 has an elongated groove 207b arranged orthogonal to the elongated holes 207a.

[0058] Referring again to Fig. 2, the clumper effect-

ing member 207 is connected through a coil spring 208 to the clamber base 205.

[0059] In fact, the coil spring 208 serves to act against the action of the spring 206, helping to release the clamping action effected by the spring 206.

[0060] Further, as shown in Figs. 2, 14 and 16, a switching member 12 and a detecting switch 13 (operated by the switching member 12) are provided on the base 200a of the disc reproducing section 200. In detail, the switching member 12 is supported on the base 200a, in a manner such that it can freely pivotable about the pivot shaft 12a in the horizontal plane and that it is urged in the clockwise direction by virtue of a coil spring (not shown) combined with the pivot shaft 12a. Moreover, the switching member 12 has an engaging member 12b located in the vicinity of the pickup 203. When an edge portion of the turntable 201 gets in contact with the engaging member 12b, the switching member 12 will be caused to rotate (about the pivot shaft 12a) in the counter clockwise direction against the urging force of the coil spring (not shown), thereby switching ON the detecting switch 13.

[0061] Moreover, when the optical pickup 203 approaches a certain part of the turntable 201 corresponding to the innermost circumferential portion of a disc, such kind of fact can also be detected easily by a contact between the pickup 203 and the engaging member 12.

[0062] Further, a switch arm 12A having an engaging portion 12c is provided on the other end of the switching member 12. In this way, when an outer edge portion of a disc transported hereto by the driving rollers 101 get in contact with the engaging portion 12c, the switching member 12 will also be caused to rotate (about the pivoting shaft 12a) in the counter clockwise direction against the urging force of the coil spring (not shown), thereby switching ON the detecting switch 13 so as to stop the driving rollers 101.

[0063] Referring again to Figs. 10 and 14, the movable chassis 400 is formed with an arc-shaped groove 402, and a movable pin 3 is engaged in the arc-shaped groove 402. Further, the movable pin 3 is also engageable in an elongated groove 207b of the clamp effecting member 207. By virtue of the driving mechanism (not shown), the movable pin 3 will be caused to move along the arc-shaped groove 402.

[0064] By moving the movable pin 3 along the arc-shaped groove 402, the disc reproducing section 200 is allowed to pivot (turn) between a reproducing position and a non-reproducing position, and a desired disc clamping action can be effected. As shown in Fig. 14 and Fig. 15, when the disc reproducing section 200 is in a non-reproducing position, the converged portion 205a of the clamber base 205 is lying over the roller 207c of the clamp effecting member 207, so that the clamber 202 is separated from the turntable 201, i.e., a clamping action has been released.

[0065] Further, by virtue of a driving mechanism

(not shown), the movable pin 3 may be moved along the arc-shaped groove 402 in a direction indicated by an arrow shown in Fig. 14A. In this way, the disc reproducing section 200 may be pivoted to a reproducing position indicated by 2-dot chain line shown in Fig. 16.

[0066] Immediately before the movable pin 3 arrives at the end of the arc-shaped groove 402, i.e., immediately before the disc reproducing section 200 is turned to its reproducing position, the movable pin 3 will be driven in a direction generally parallel with the elongated holes 207a of the clamp effecting member 207. In this way, the clamp effecting member 207 is allowed to have a displacement with respect to the base 200a of the reproducing section 200, in a longitudinal direction of the elongated holes 207a of the member 207. As a result, the converged portion 205a of the clamber base 205 will move away from the roller 207c of the clamp effecting member 207, so that the clamber 202 will press against the turntable 201 by virtue of the urging force of the spring 206, thereby effecting a clamping action.

[0067] At this moment, since the displacement of the member 207 will cause the coil spring 208 to expand to some extent, the coil spring 208 itself will produce an urging force in its retracting direction, thereby urging the base 200a towards the reproducing position 200. In this way, it is possible to inhibit a possible clattering of the base 200a when it is in the reproducing position, thereby ensuring a correct positioning of the disc reproducing section 200.

[0068] The operation of the disc reproducing apparatus made according to the present invention will be described in the following with reference to Figs. 17 to 23.

[0069] When a disc is to be reproduced from its innermost circumferential position, the pickup 203 of the disc reproducing section 200 is moved by the pickup moving mechanism 204 so as to arrive at a position close to the turntable 201 and corresponding to the innermost circumferential position of the disc.

[0070] In this way, the pickup 203 gets in contact with the engaging portion 12b of the switching member 12, so as to cause the switching member 12 to pivot in the counter clockwise direction, thereby switching ON the detecting switch 13. At this time, once it is detected that the pickup 203 is moving to a further inner circumferential position inwardly of the innermost circumferential position of the disc, the pickup moving mechanism 204 will be stopped immediately, thereby preventing the pickup 203 from bumping into the turntable 201. Then, the pickup 203 is caused to move back until the detecting switch 13 changes back to its OFF state, thereby preventing the exerting of an unnecessary load on the disc and the driving rollers 101.

[0071] Referring to Fig. 17, six disc trays 301 are arranged one upon another in the direction Z, the pins 400c are located at the lowermost positions of the inclined elongated holes 6c, with the movable chassis



400 being located at the lowermost position in the reproducing apparatus. At this time, each wedge member 410 is separated away from the trays 301, thereby avoiding a collision between the wedge members 410 and the disc trays 301 during the vertical movement of the movable chassis 400.

[0072] Referring to Fig. 18, when the slide plates 5 and 6 are driven, the movable chassis 400 will be moved upwardly. After the pins 400c are moved upwardly by one step, the movable chassis 400 is stopped. At this height, the wedge members 410 are enabled to hold a second tray 301 (counting from below).

[0073] In fact, each of the inclined elongated holes 6c has six steps corresponding to six different heights of the six disc trays 301. For example, when the second tray 301 (counting from below) is to be held by the wedge members 401, the pins 400c are needed to be located at a second step (counting from below) of the inclined elongated holes 6c.

[0074] Referring again to Fig. 18, when the second tray 301 (counting from below) is to be held by the wedge members 401, the wedge members 401 are rotated in the counter clockwise direction. At this time, the cam surface 410d of each wedge member 410 will push upwardly against each projection 301f of a third tray 301 (counting from below), thereby upwardly moving the third to sixth trays 301 (counting from below). At this moment, each projection 301f of the second tray 301 (counting from below) is caused to move over the cam surface 410e of each wedge member 410 and further move into the groove hole 410c of the wedge member.

[0075] Then, the slide plates 5 and 6 are driven so as to move up the movable chassis 400. In this way, the third to sixth trays 301 (counting from below) are pushed upwardly by the cam surface 410d, the second tray 301 (counting from below) is also moved upwardly since it is pushed upwardly by the cam surface 410e. This time, only the lowermost tray 301 is remained at its original position.

[0076] After that, the movement of the movable chassis 400 is stopped under a condition shown in Fig. 19, with the pins 400c arriving at the uppermost steps of the inclined elongated holes 6c. Thus, the second tray 301 (counting from below) is held by the wedge members 410.

[0077] At this time, the second tray 301 (counting from below) is just at a height corresponding to the position of the driving rollers 101, suitable for inserting or discharging a disc.

[0078] At this moment, the tray pressing means 304 has not been moved to touch the trays 301, but kept at a position shown in Fig. 24B.

[0079] Then, as shown in Fig. 20, each wedge member 410 is pivoted slightly in the clockwise direction. This time, although there is no change in the position of the second tray 301 (counting from below) held

by the wedge members 410, the third to sixth trays 301 are pushed upwardly by the cam surface 410d of the wedge member 410. In this way, the pair of driving rollers 101 are allowed to enter between the trays 301, so that the two driving rollers 101 are moved from their positions shown in Fig. 9 to the positions shown in Fig. 8, thereby making it possible to transport a disc through the elongated opening 11.

[0080] Then, the tray pressing means 304 is slidingly moved to allow its engaging member 304c to get in touch with the edges of the trays 301, so as to prevent a clattering of the trays 301, thereby ensuring a desired precision for the movement of the second tray 301 (counting from below). Further, since the tray pressing member 304 is in contact also with the edge of the lowermost tray 301, it is also possible to prevent a clattering of the lowermost tray 301.

[0081] Subsequently, a disc may be inserted from the elongated opening 11, and such a disc insertion movement may be detected by the photo-sensor 14a, so that the driving rollers 101 will begin to effect the loading of a disc. At this moment, if the photo-sensor 14a and the photo-sensor switch 14c are not at their ON state simultaneously, it will be determined that a disc being loaded is an 8-cm disc and this disc will be ejected.

[0082] Further, a fact that a disc is being loaded may be detected by a photo-sensor 14b.

[0083] Then, the disc is moved to the second tray 301 (counting from below). When the edge of the disc comes into contact with the engaging portion 12c of the switch arm 12A, the switching member 12 will be caused to rotate in the counter clockwise direction (Fig. 14), thereby switching ON the detecting switch 13.

[0084] Once the detecting switch 13 is switched ON, as shown in Fig. 21, the driving rollers 101 will be caused to retract from between the trays 301 without causing any movement of the disc toward the rollers 101. In this way, the disc is allowed to smoothly drop on to the second tray 301 (counting from below). Afterwards, the slide plates 5 and 6 are driven so that the movable chassis 400 is lowered. When the pins 400c arrive at the second step (counting from below) of the inclined holes 6c, the movable chassis 400 is stopped. At this time, the movable chassis 400 is at a position shown in Fig. 18. Further, the wedge members 410 are caused to rotate in the counter clockwise direction, so as to release the contact between the projections 301f of the trays 301 and the cam surfaces 410d and 410e of the wedge members 410.

[0085] Subsequently, the slide plates 5 and 6 are driven again so that the movable chassis 400 is lowered still further. When the pins 400c arrive at the lowermost positions of the inclined holes 6c, the movable chassis 400 is stopped. At this time, the movable chassis 400 is at a position shown in Fig. 17. Up to this, a series of disc loading operations have thus been finished.

[0086] A disc mounted on any one of the trays 301



(for example, the second tray 301 counting from below) may be reproduced in the following, with reference to Figs. 17, 18 and Figs. 22, 23.

**[0087]** Starting from a condition shown in Fig. 17, when the disc mounted on the second tray 301 (counting from below) is to be reproduced, the movable chassis 400 is moved so that the disc reproducing section 200 is moved to a height corresponding to the second tray 301 (counting from below).

**[0088]** Namely, the slide plates 5 and 6 are driven so that the movable chassis 400 is moved upwardly until the pins 400c arrive at the second steps (counting from below) of the inclined elongated holes 6c. In this way, since the movable chassis 400 has been positioned at a height shown in Fig. 18, the disc mounted on the second tray 301 (counting from below) is in a reproducible condition.

**[0089]** After that, in order to ensure a necessary space between the discs trays 301 for the reproducing section 200 to enter therein, the wedge members 410 are caused to rotate in the clockwise direction, as shown in Fig. 18. Thus, the cam surface 410d of each wedge member 410 will push upwardly the projection 301f of the third tray (counting from below), thereby upwardly moving the third to sixth trays 301 (each counting from below).

**[0090]** Meanwhile, each projection 301f of the second tray 301 (counting from below) will move over the cam surface 410e and into the groove hole 410c of each wedge member 410. At this time, each projection 301f of the lowermost tray 301 will get in contact with the cam surface 410e of each wedge member 410.

**[0091]** Subsequently, the wedge members 410 are further rotated in the clockwise direction, thereby further upwardly moving the third to sixth trays 301 (each counting from below), as shown in Fig. 18. At this time, each projection 301f of the second tray 301 (counting from below) is raised up by the cam surface 410f, while each projection 301f of the lowermost tray 301 is pressed by the cam surface 410e so that the lowermost tray 301 is not moved. In this way, around the second tray 301 (counting from below), a space necessary for the disc reproducing section 200 to enter therein is thus formed, as shown in Fig. 18. This time, each projection 301f of the second tray 301 (counting from below) gets further deep into the groove hole 410c, so that the second tray 301 is firmly held by the wedge members 410.

**[0092]** Then, as shown in Fig. 22, the reproducing section driving mechanism is driven, so that the disc reproducing section 200 is moved from its non-reproducing position (Fig. 14) to its reproducing position (Fig. 16).

**[0093]** Meanwhile, the clasper 202 is lowered so as to press the disc in a predetermined manner. At this moment, the wedge members 410 are slightly rotated in the counter clockwise direction so as to slightly lower down the second tray 301 (counting from below). In this

way, the disc mounted on the second tray 301 is moved on to the turntable 201, thus separating the disc from the tray 301, thereby making it possible to reproduce the disc under a condition shown in Fig. 23.

**[0094]** By virtue of the above counter clockwise rotation of the wedge members 410, the third to sixth trays 301 (counting from below) are allowed to move down from a position shown in Fig. 22. Therefore, a space occupied by the third to sixth trays in the direction Z is allowed to be smaller than a space shown in Fig. 22.

**[0095]** With the use of the present invention, since each of a plurality of the disc trays is allowed to independently move in the tray arranging direction, when a disc is to be loaded into the disc holder or when a selected disc mounted on any one of the disc trays is to be reproduced, only a related tray has to be adjusted and kept at a proper position (a correct height) without having to move the whole disc holder (which includes the plurality of trays), thereby ensuring an improved precision for keeping the related tray at a correct position.

**[0096]** Further, with the use of the present invention, when a disc is to be loaded into the disc holder or when a selected disc mounted on any one of the disc trays is to be reproduced, since it is not necessary to move one or more disc trays located below a selected disc, a necessary driving force for driving the trays is allowed to be reduced, thereby allowing the reduction of a load exerted on a driving mechanism.

**[0097]** While the presently preferred embodiments of this invention have been shown and described above, it is to be understood that these disclosures are for the purpose of illustration and that various changes and modifications may be made without departing from the scope of the invention as set forth in the appended claims.

## Claims

### 1. A disc reproducing apparatus, comprising:

- a disc holder for receiving a plurality of discs;
- a disc transporting means for transporting a disc inserted from outside into the disc holder;
- and
- a disc reproducing means for reproducing a disc selected from the plurality of discs received in the disc holder;
- wherein the disc holder includes a plurality of trays each for mounting one disc, guide means allowing the trays to move only in tray arranging direction, a fixed bottom plate for supporting the plurality of trays, a movable top plate movable only in the tray arranging direction by virtue of the guide means;
- wherein the movable top plate is urged towards the fixed bottom plate by virtue of urging means.

2. The disc reproducing apparatus according to claim 1, wherein said apparatus includes tray holding means for holding a tray selected from the plurality of the trays, and moving means for moving the tray holding means to a predetermined height in the tray arranging direction. 5
3. The disc reproducing apparatus according to claim 2, wherein said predetermined height is a height for completing a desired disc transportation by using the disc transporting means, or a height for reproducing a selected disc by using the disc reproducing means. 10
4. The disc reproducing apparatus according to claim 2, wherein the tray holding means and the disc reproducing means are integrally moved in the tray arranging direction by virtue of the moving means. 15
5. The disc reproducing apparatus according to claim 1, wherein said apparatus further includes a tray pressing means movable between a contact position for contacting the trays and a non-contact position separated from the trays. 20
6. The disc reproducing apparatus according to claim 5, wherein when any one tray is selected from the plurality of the trays, the tray pressing means will get in contact with one or more trays located below the selected tray. 25 30
7. The disc reproducing apparatus according to claim 1, wherein the urging means is comprised of spring members provided between the movable top plate and a fixed bottom plate, with the fixed bottom plate secured on the main chassis of the disc reproducing apparatus. 35

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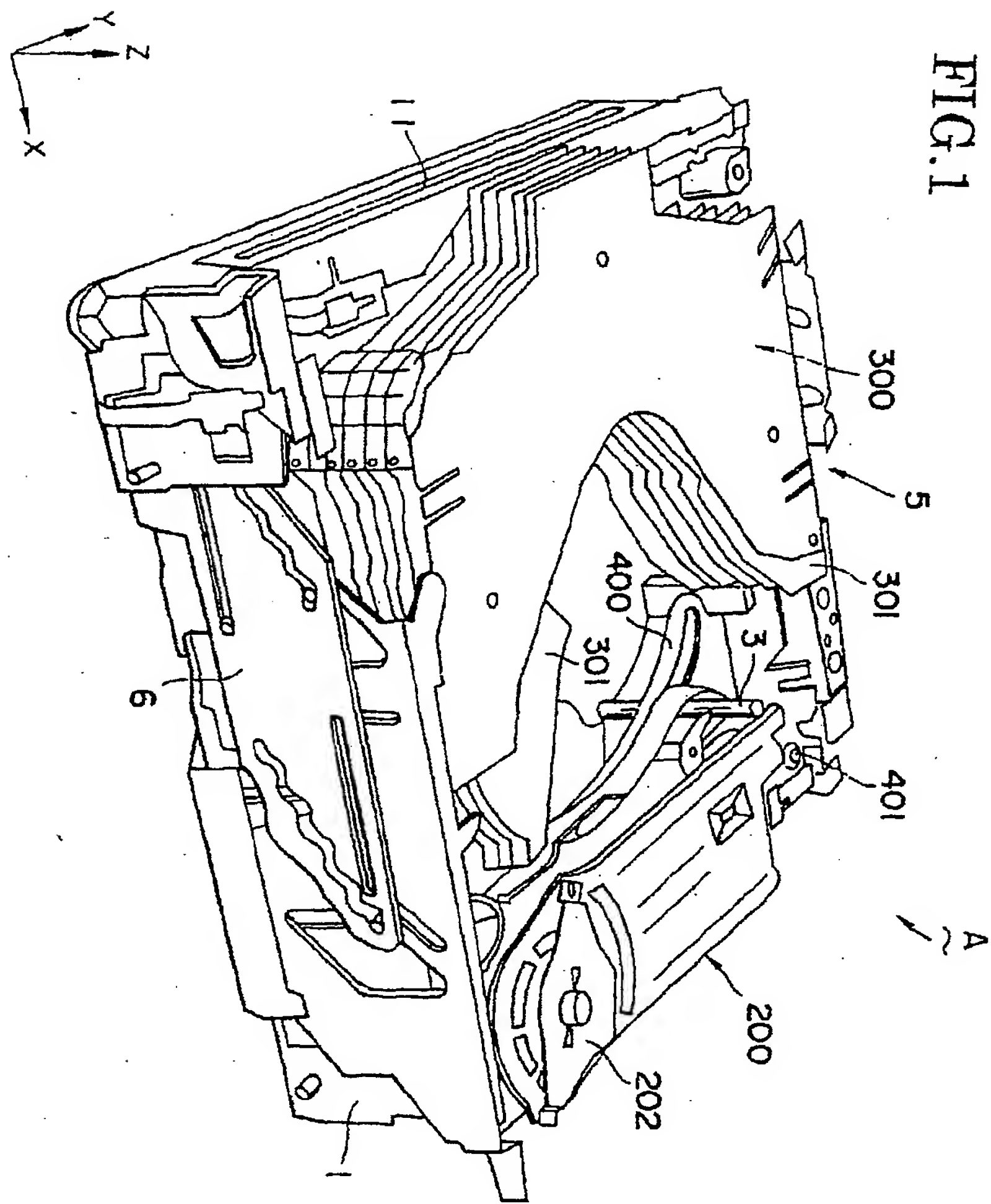
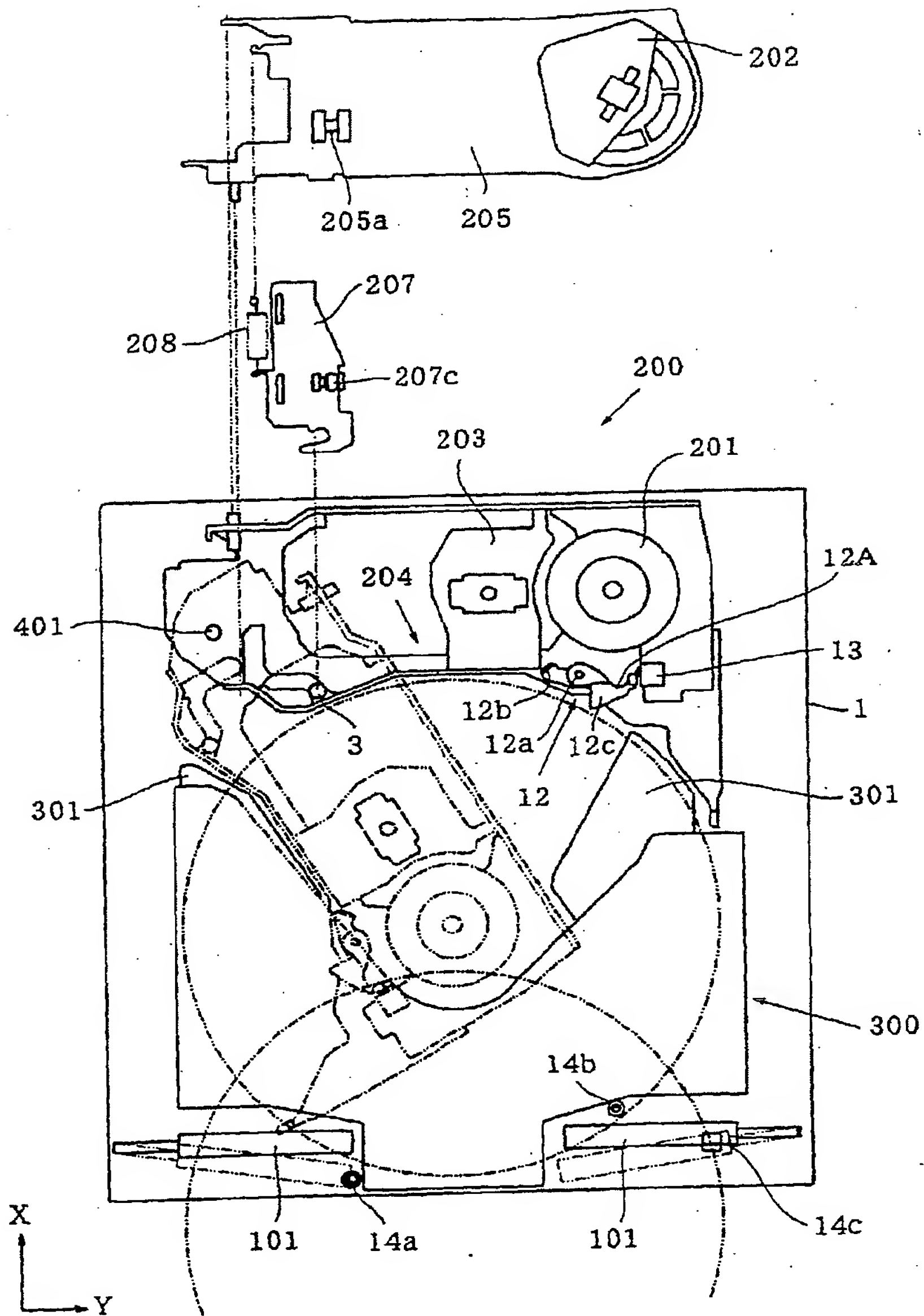


FIG.2





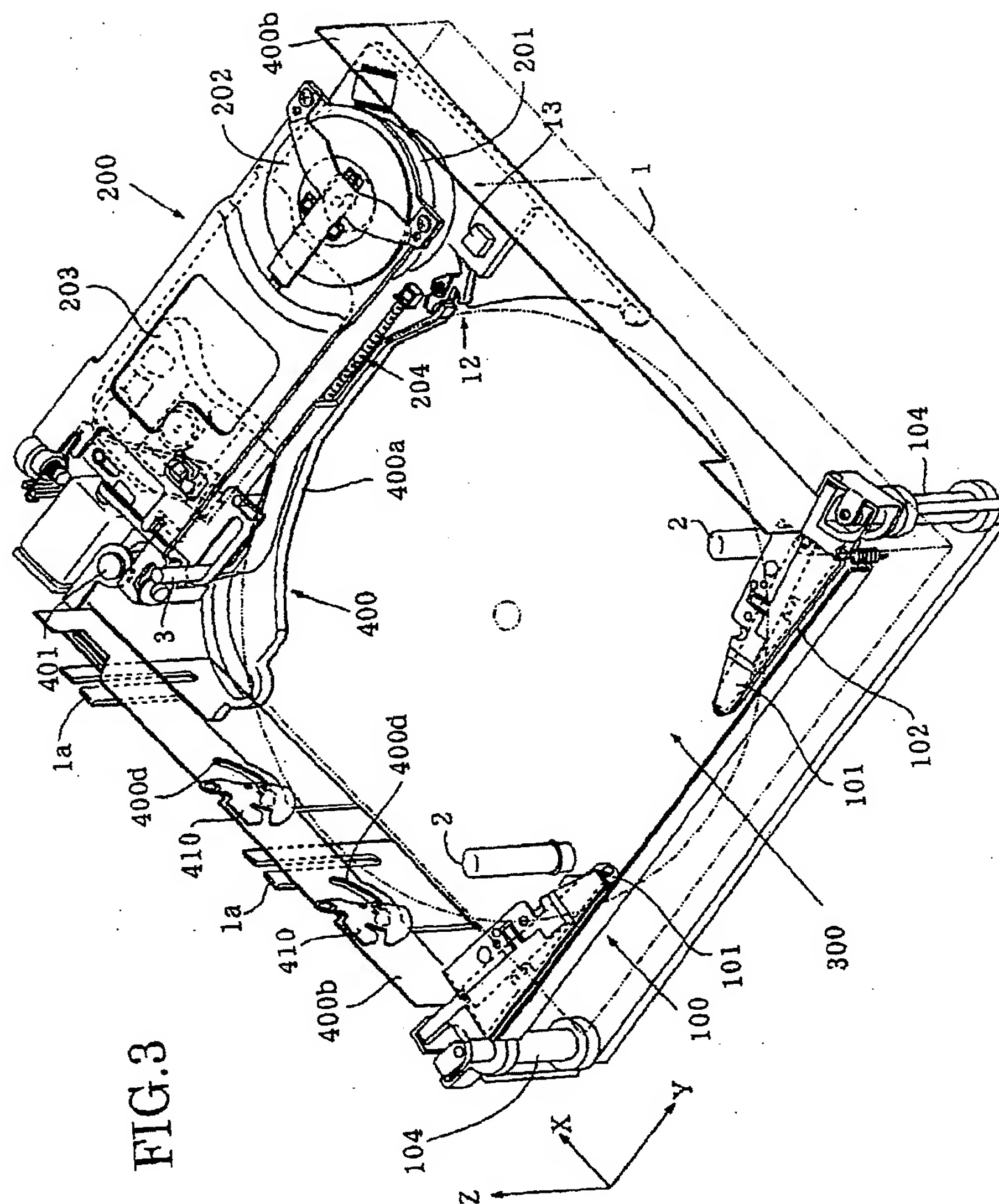


FIG.4 A

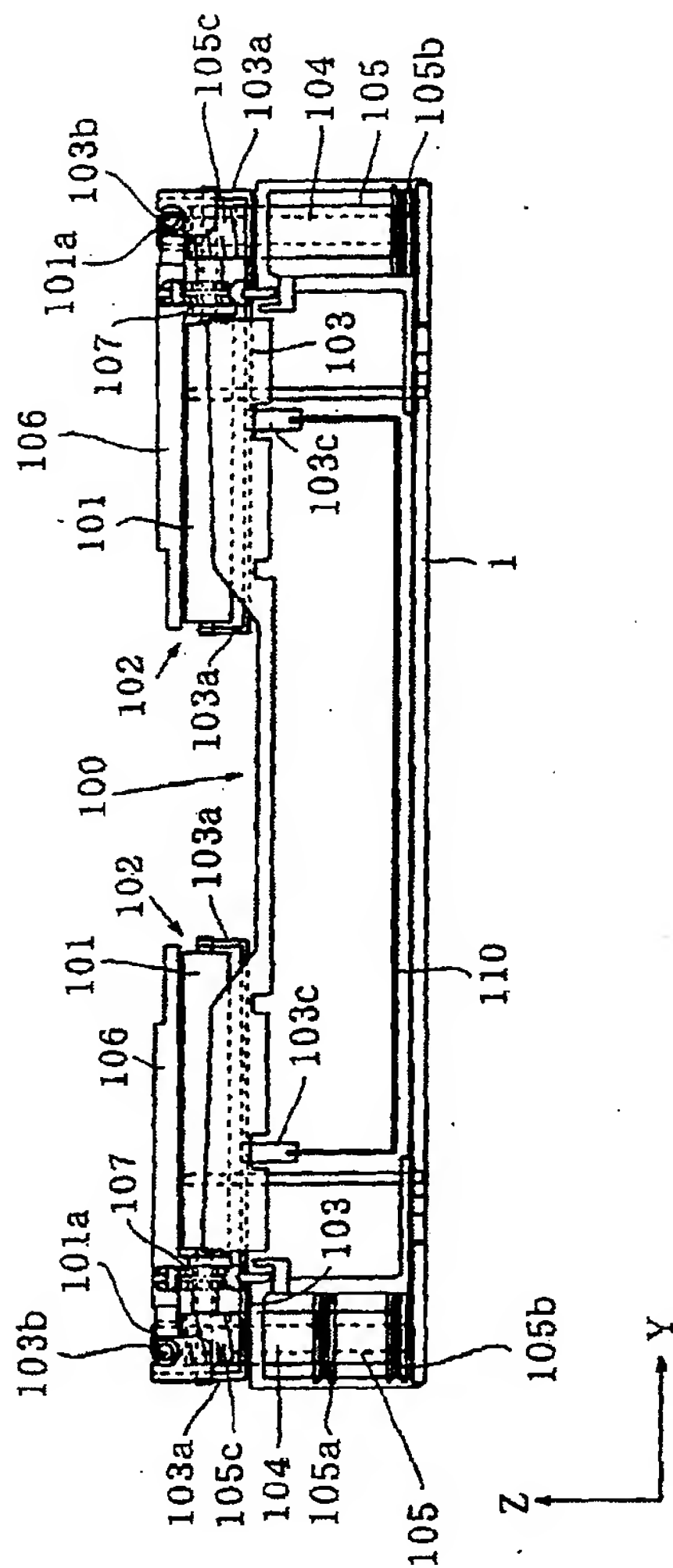


FIG.4 B

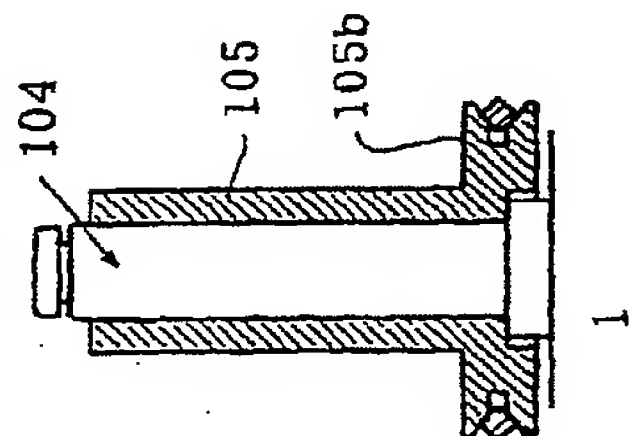


FIG.4 C

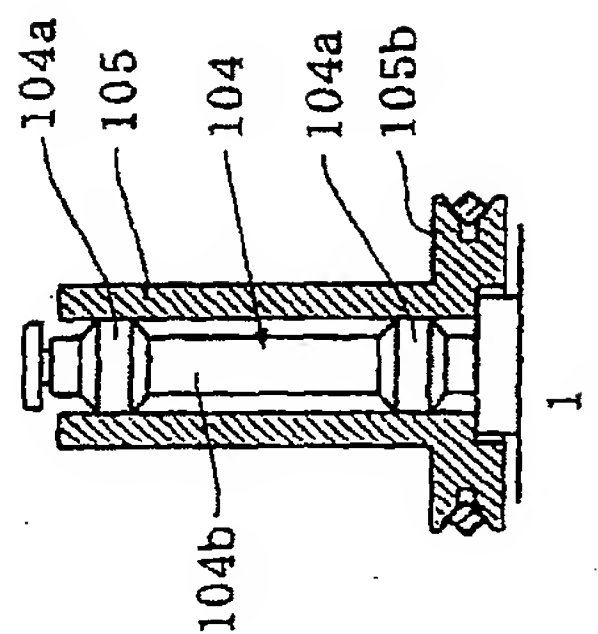




FIG.5

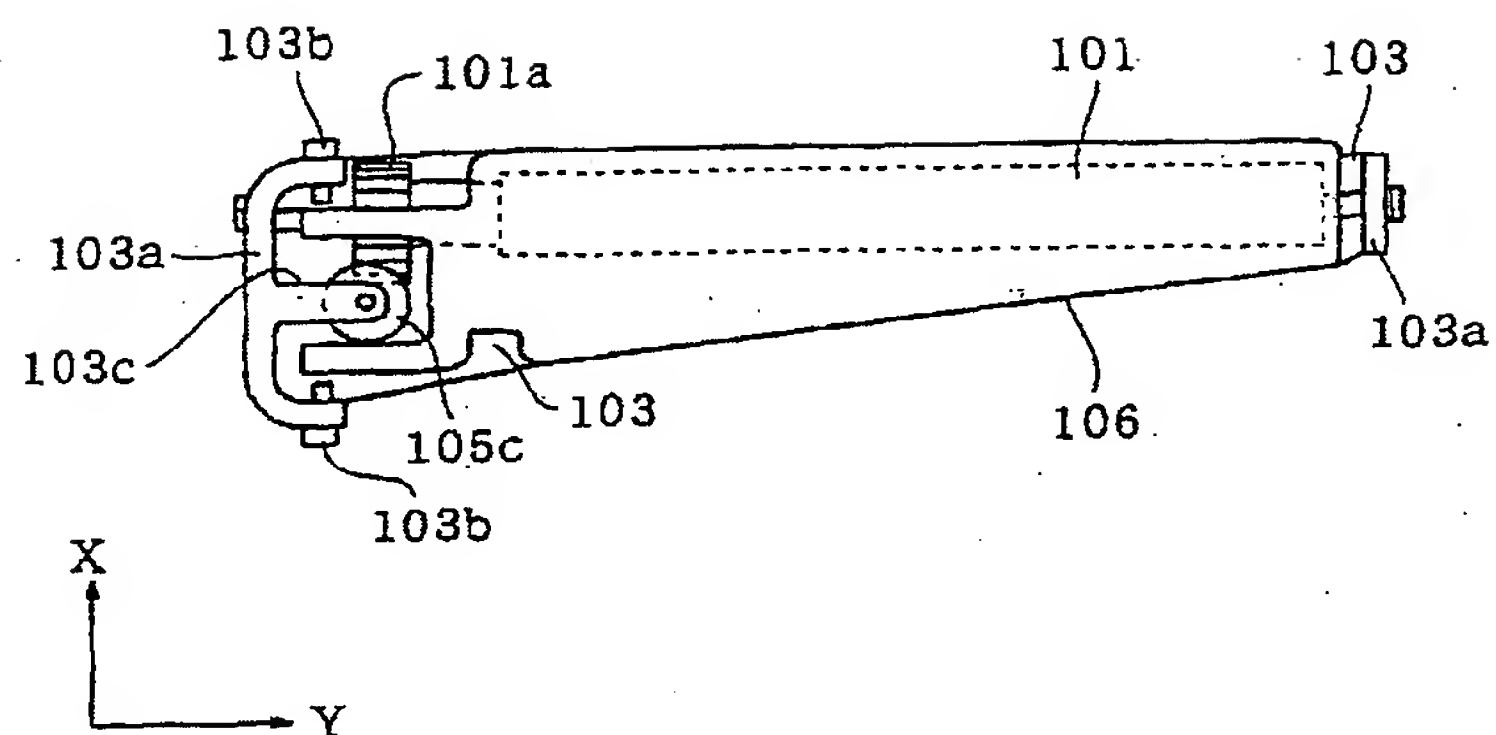


FIG.6

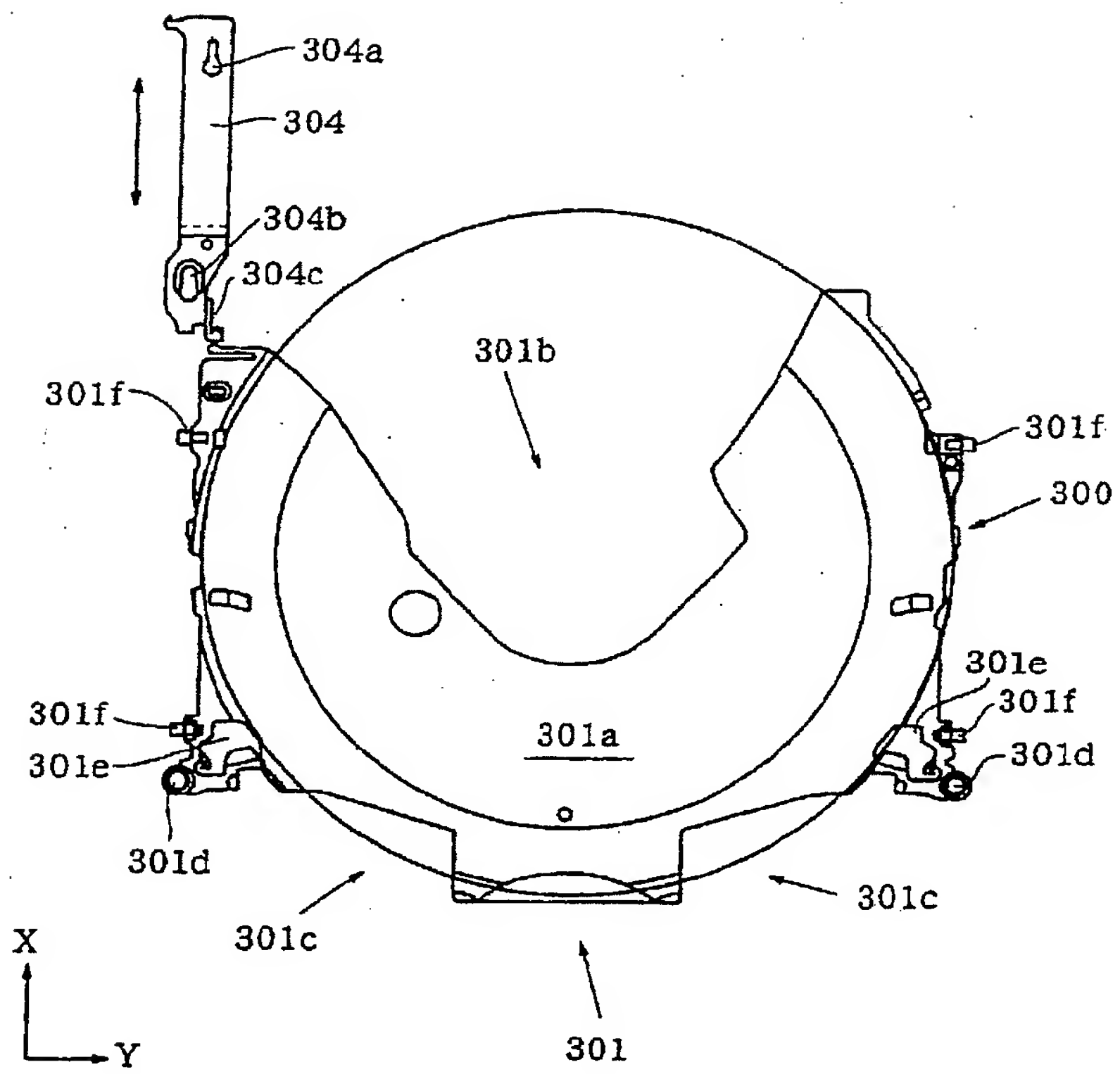




FIG. 7

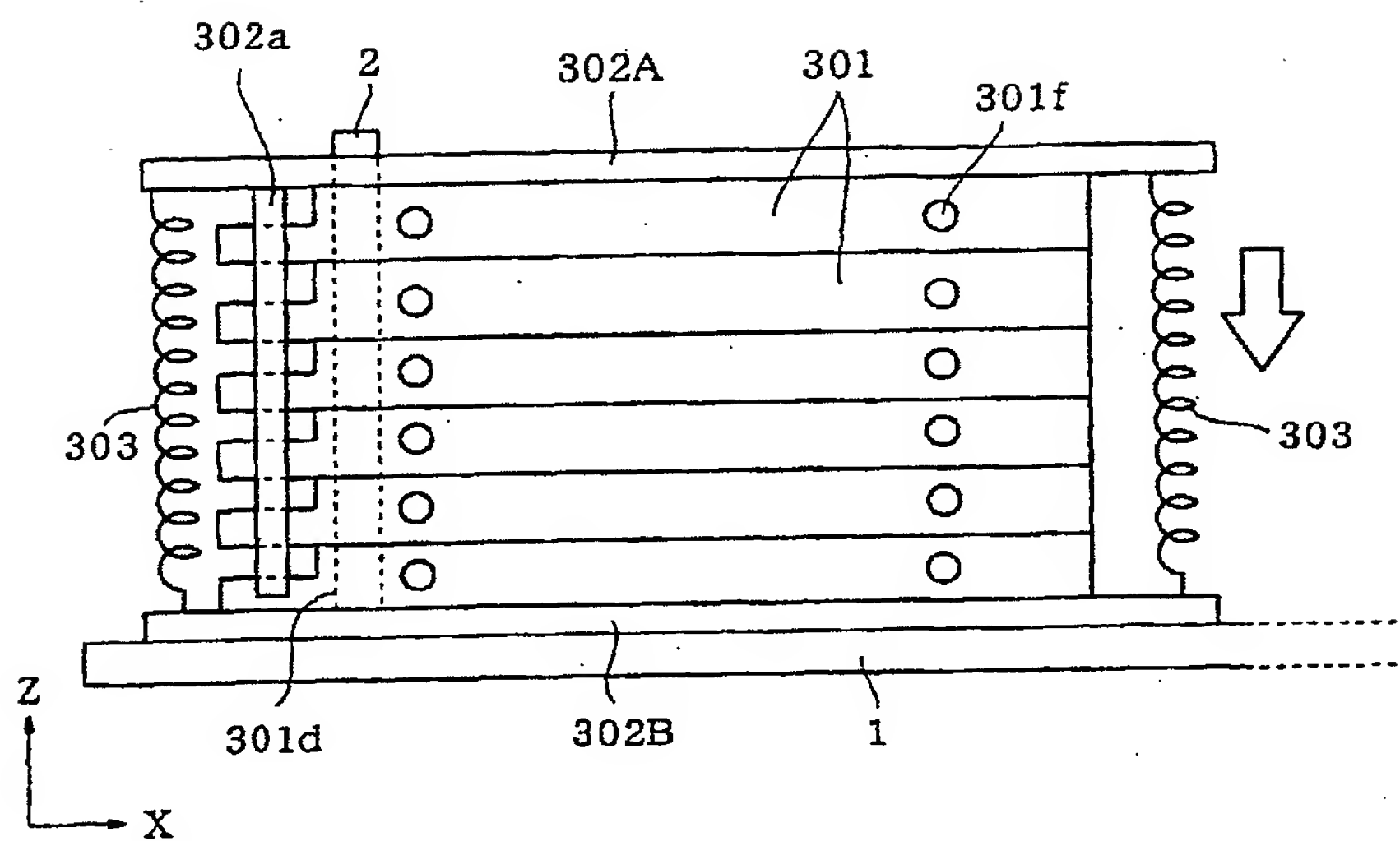


FIG.8

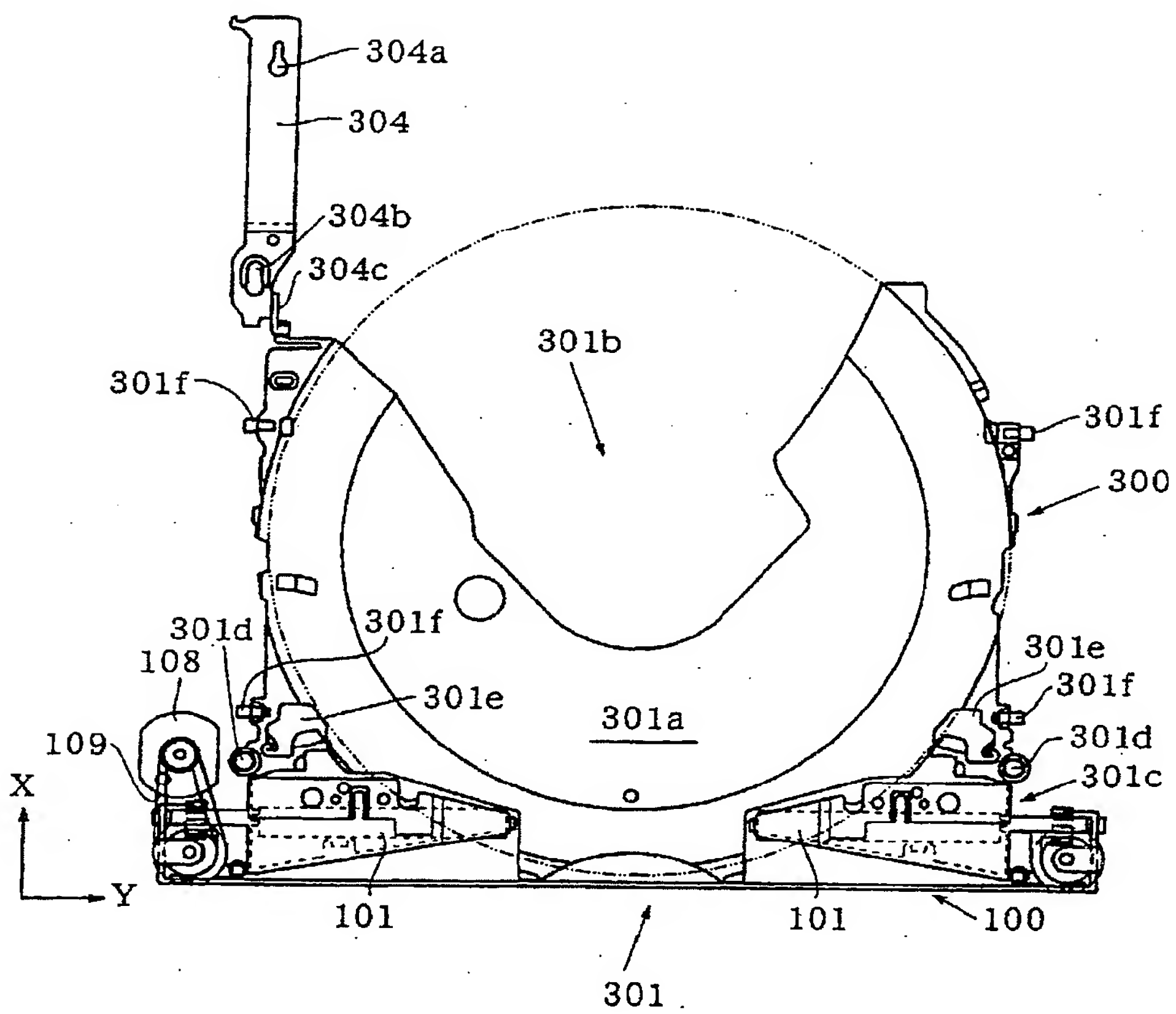


FIG.9

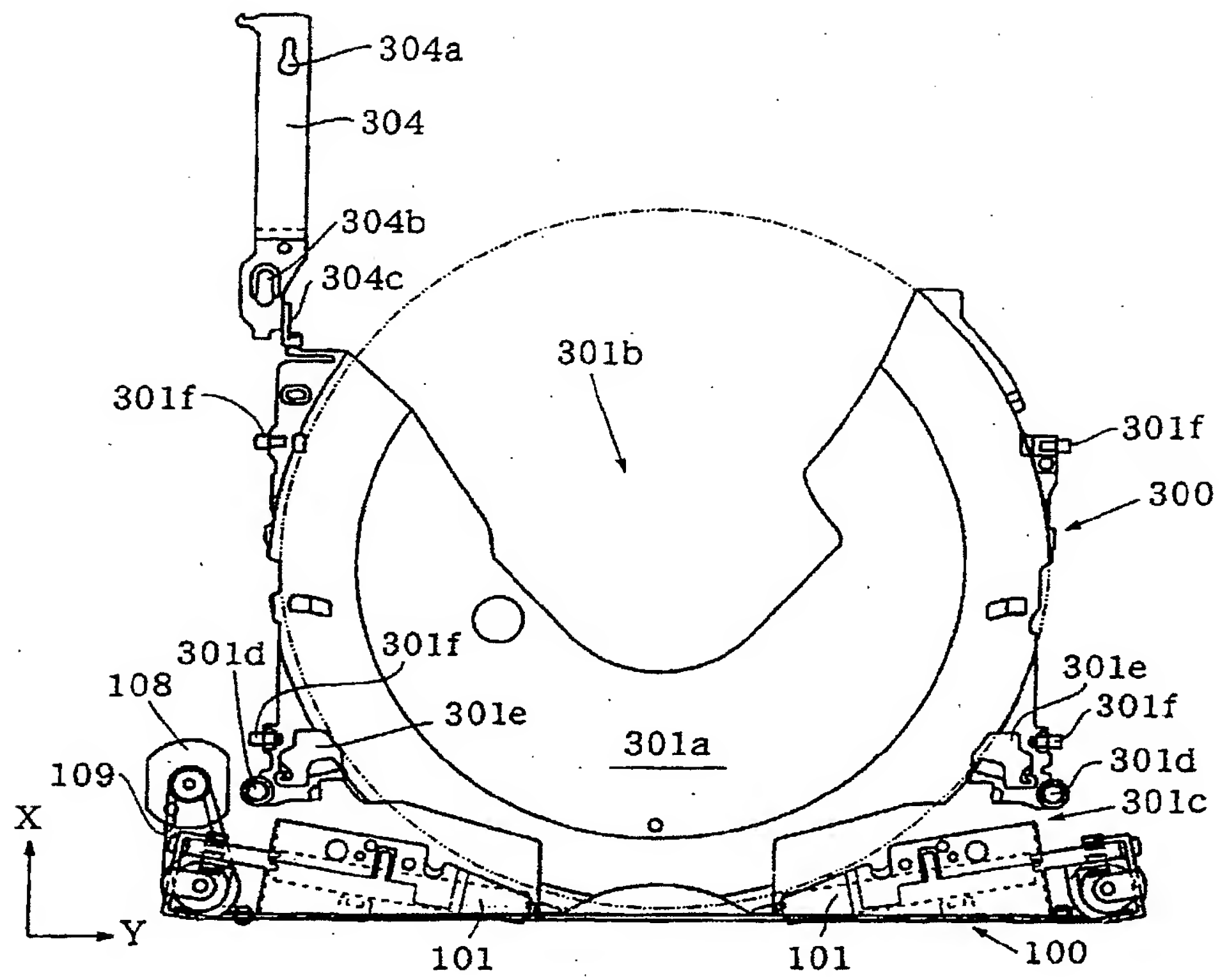




FIG.10

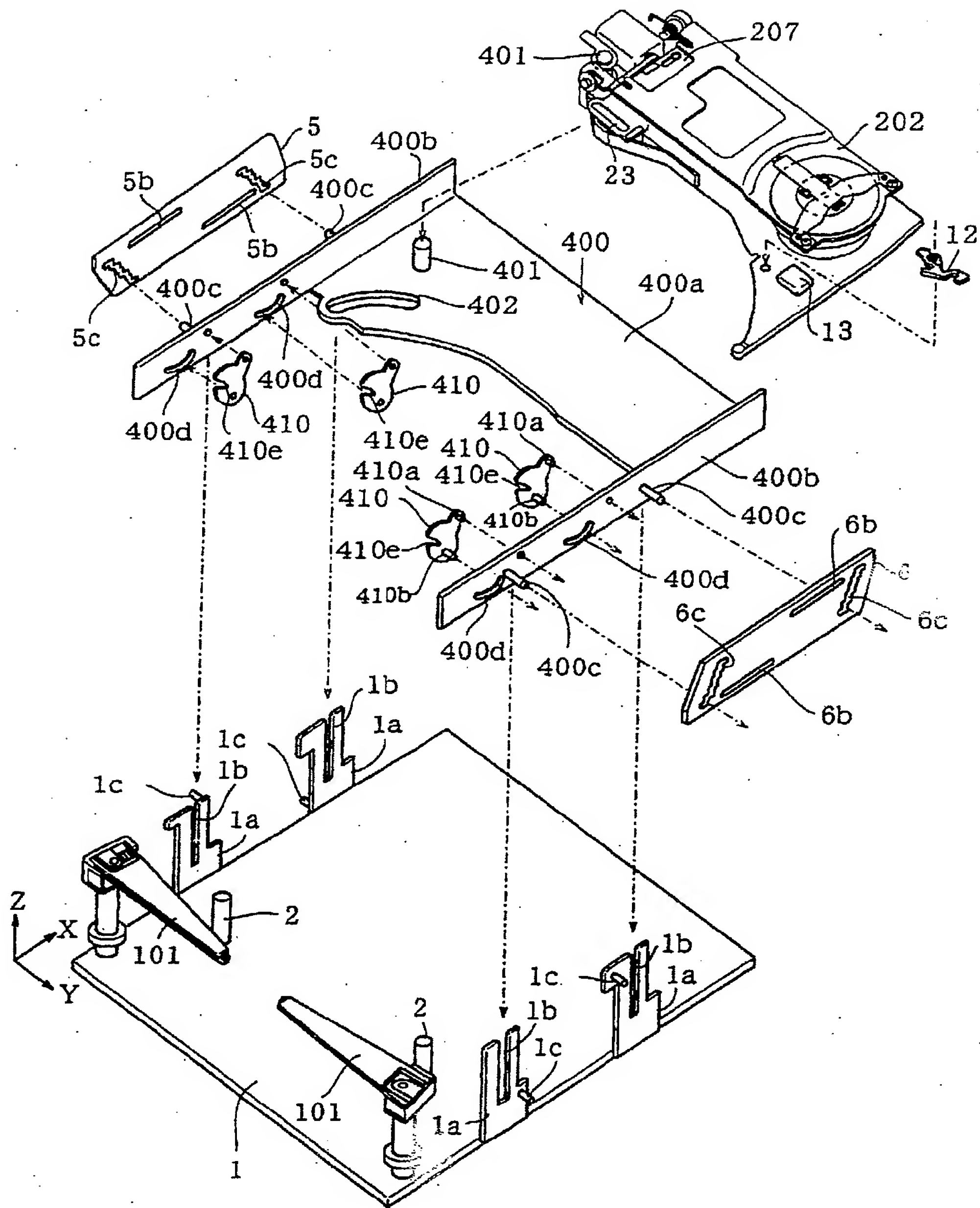


FIG.11

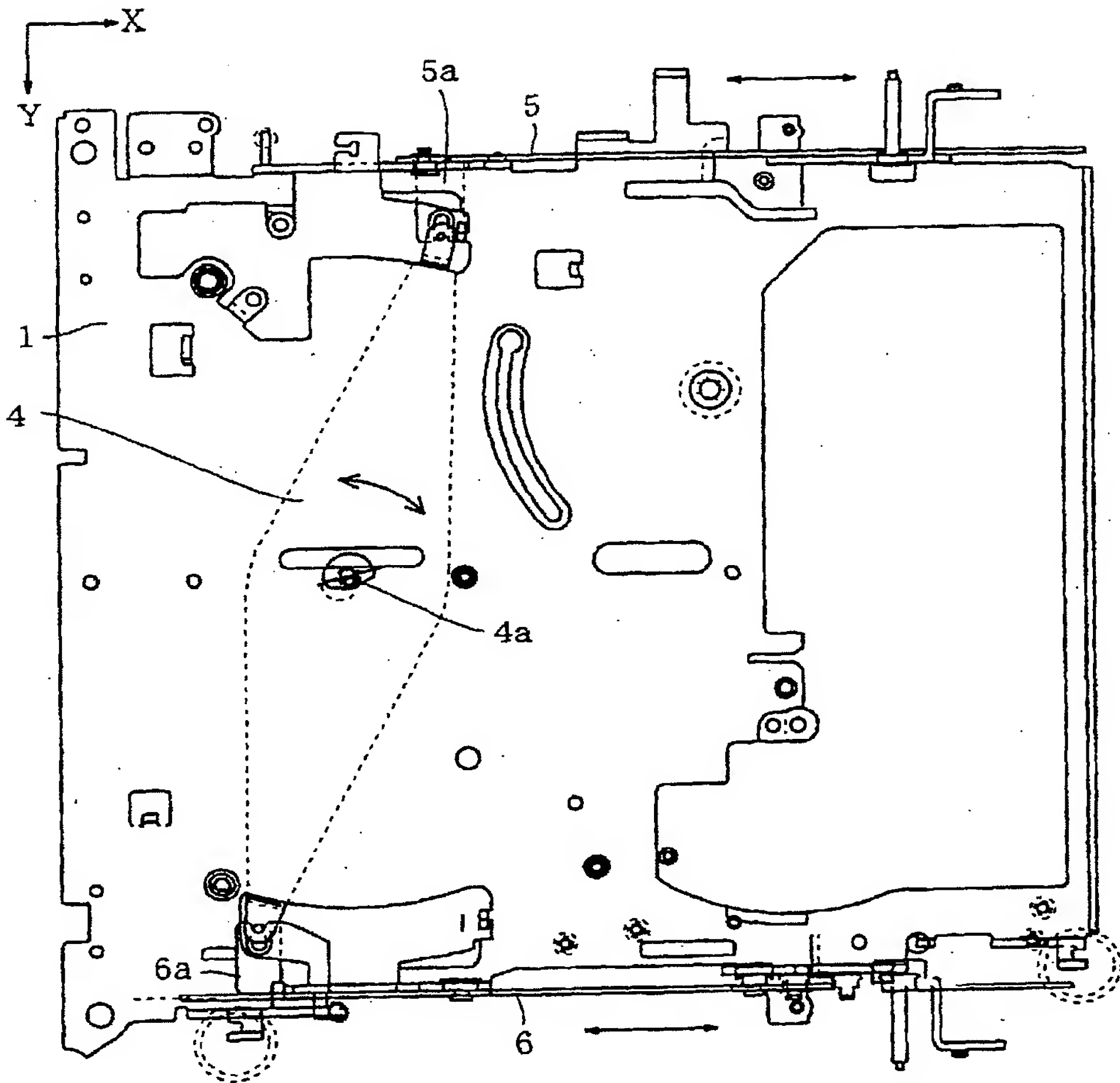


FIG.12

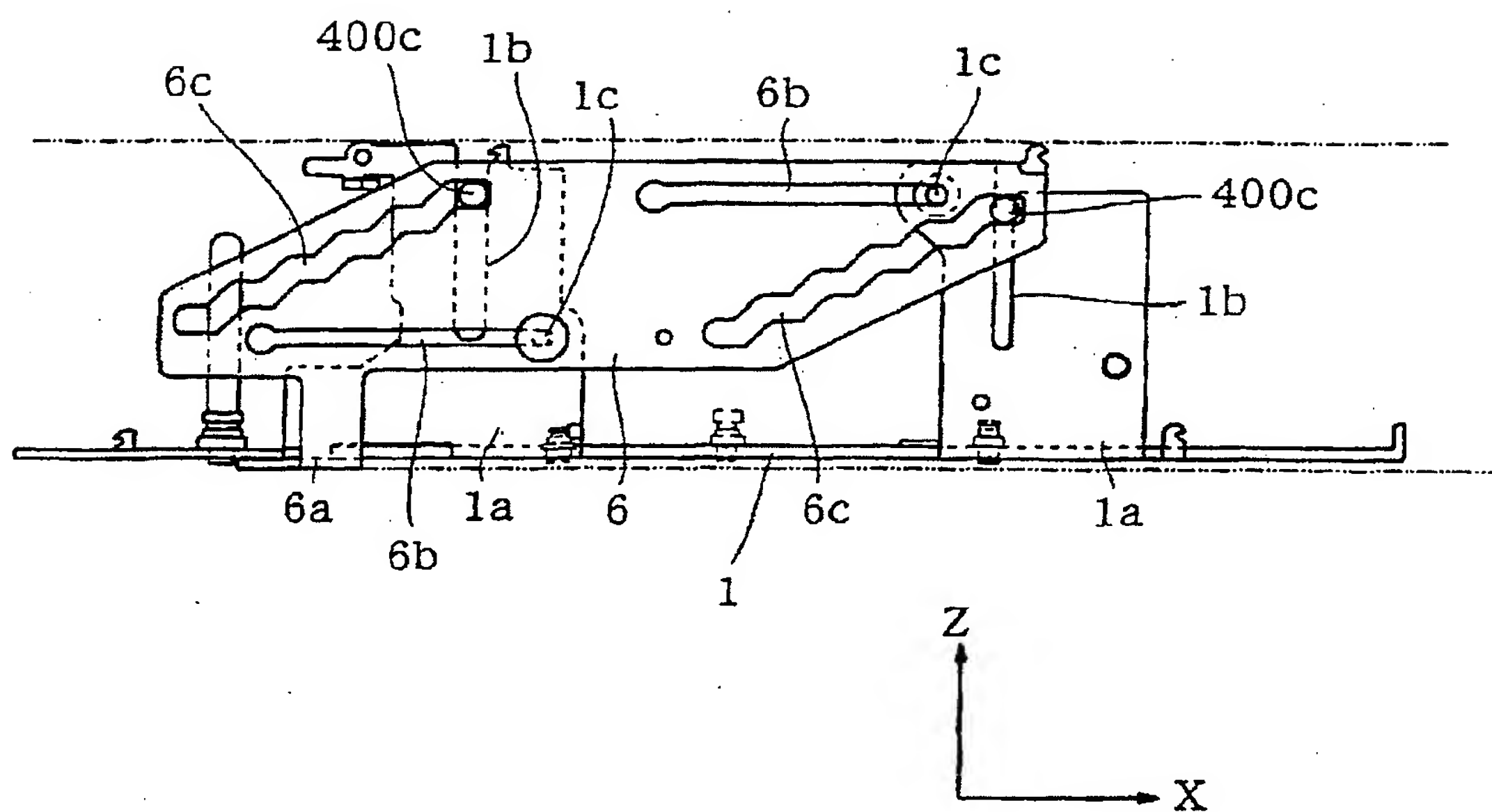


FIG.13

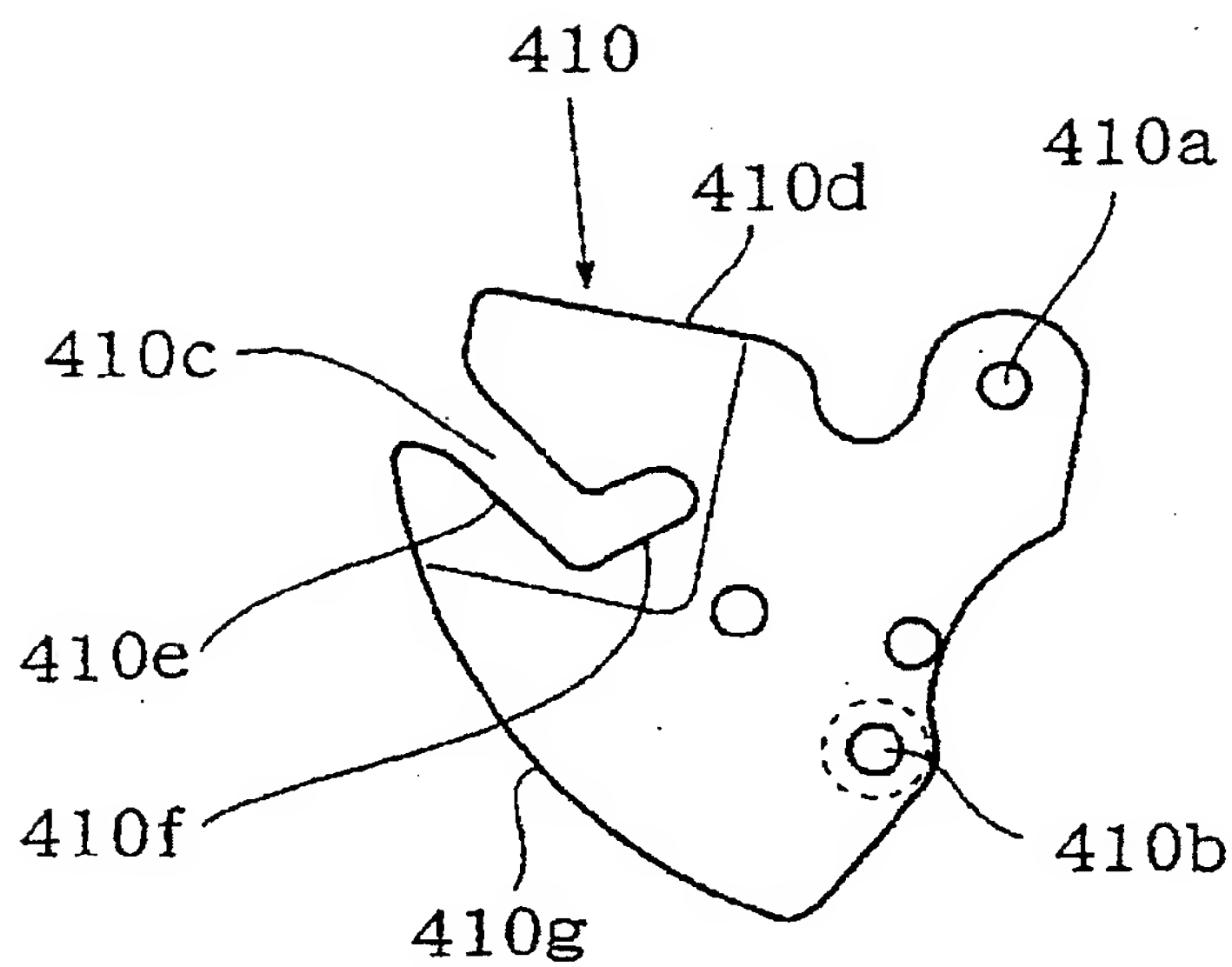




FIG.14 A

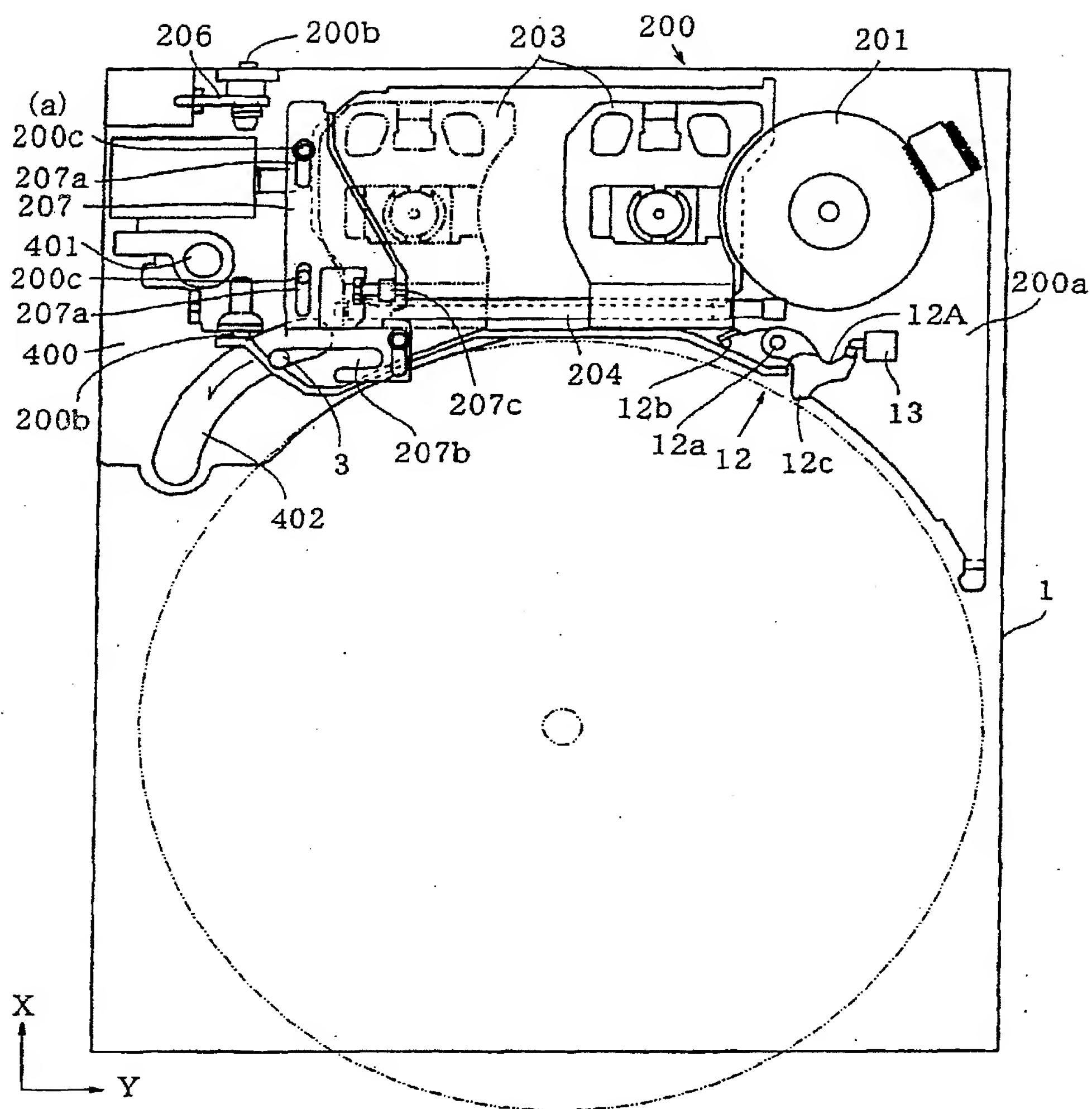


FIG.14 B

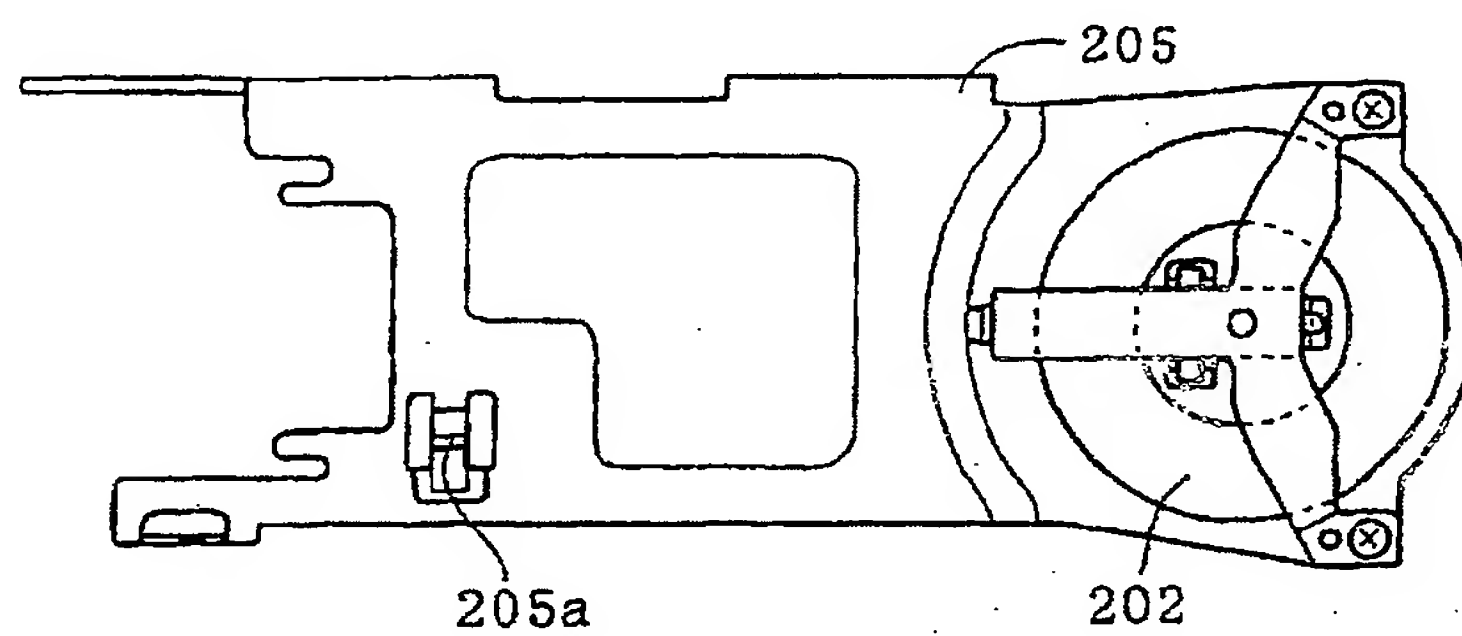


FIG.15 A

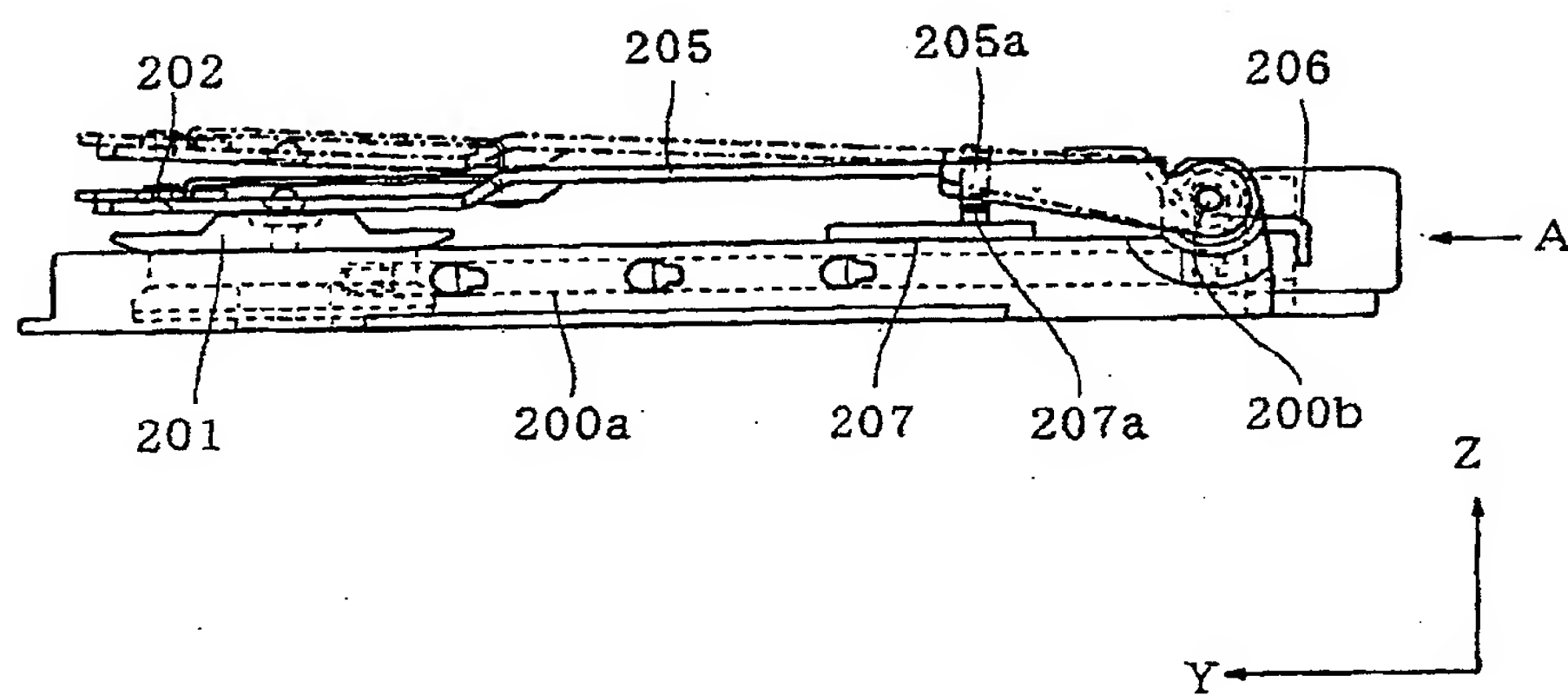


FIG.15 B

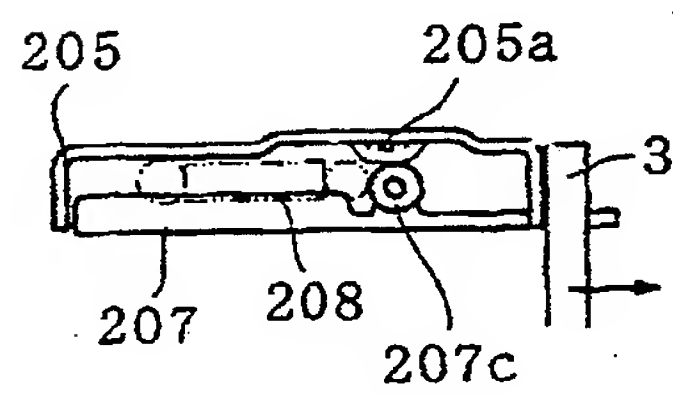


FIG.15 C

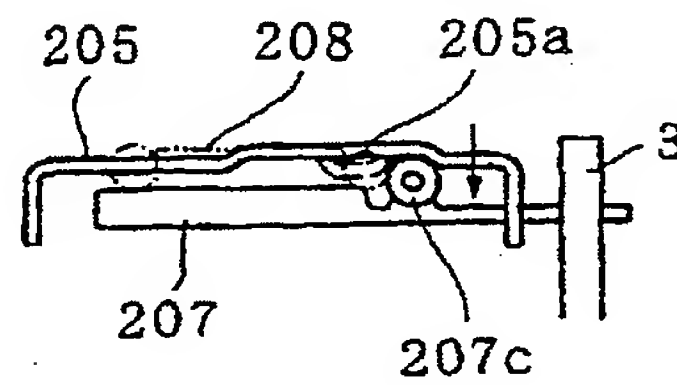


FIG.16

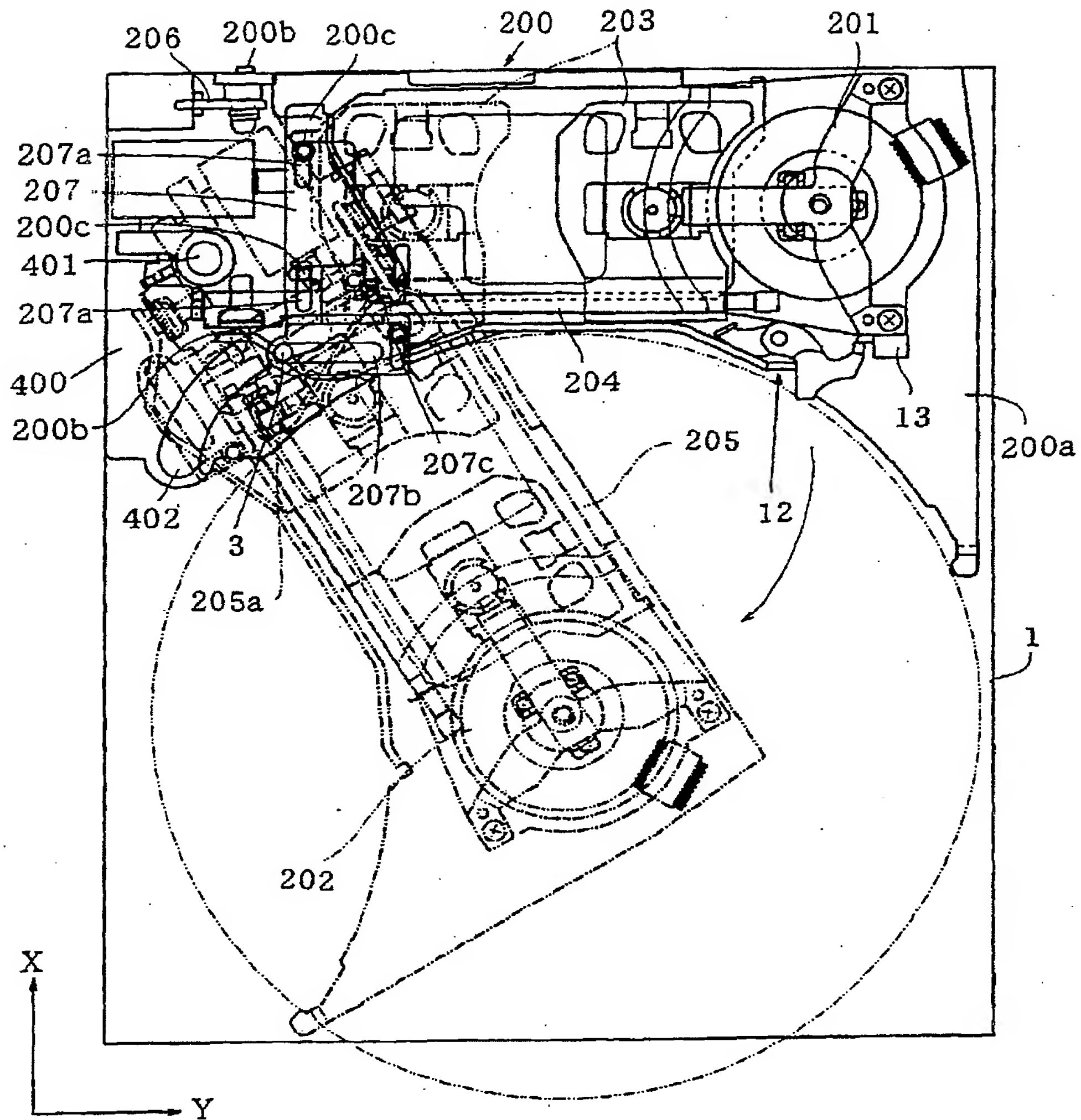


FIG.17

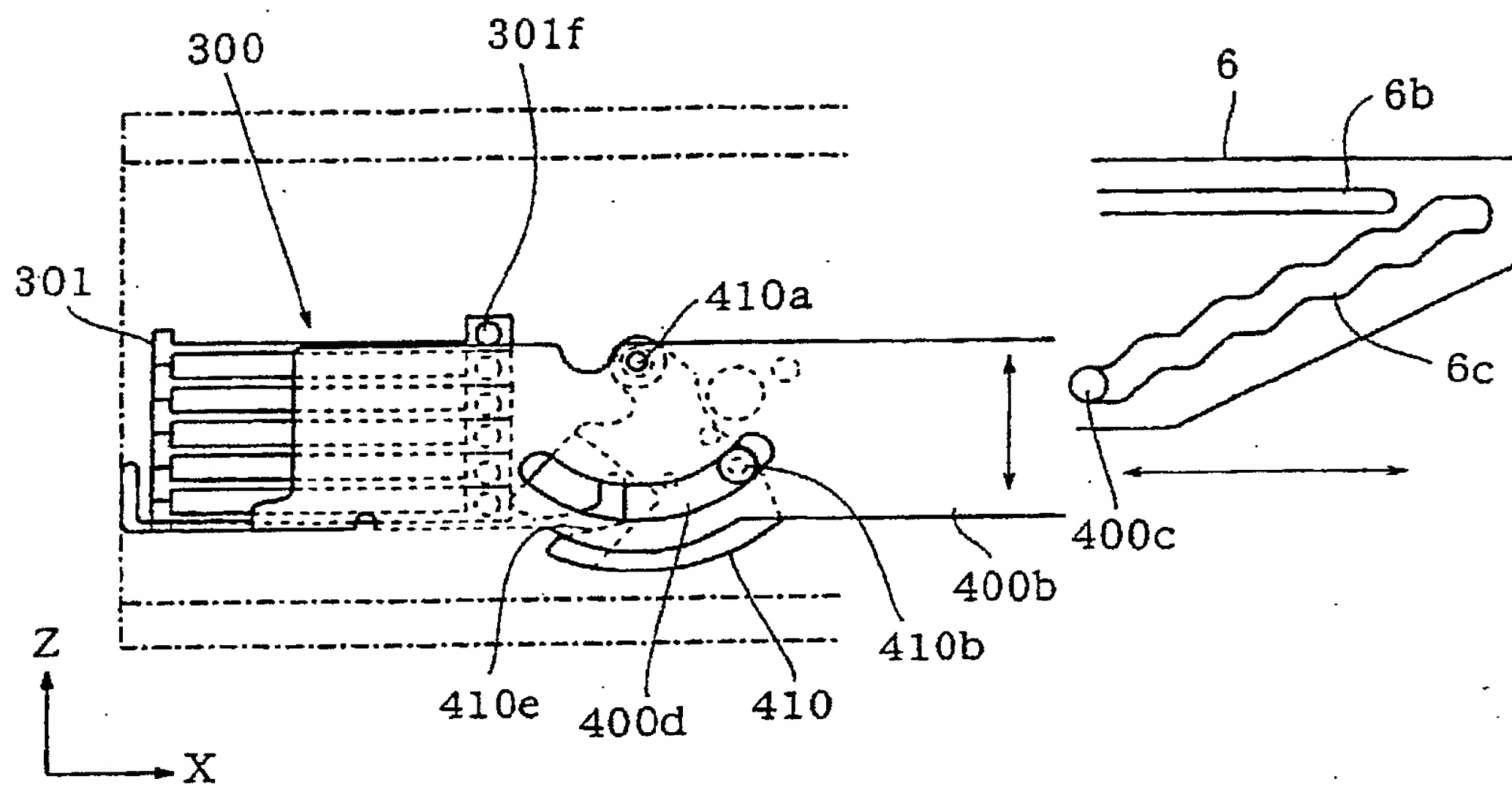


FIG.18

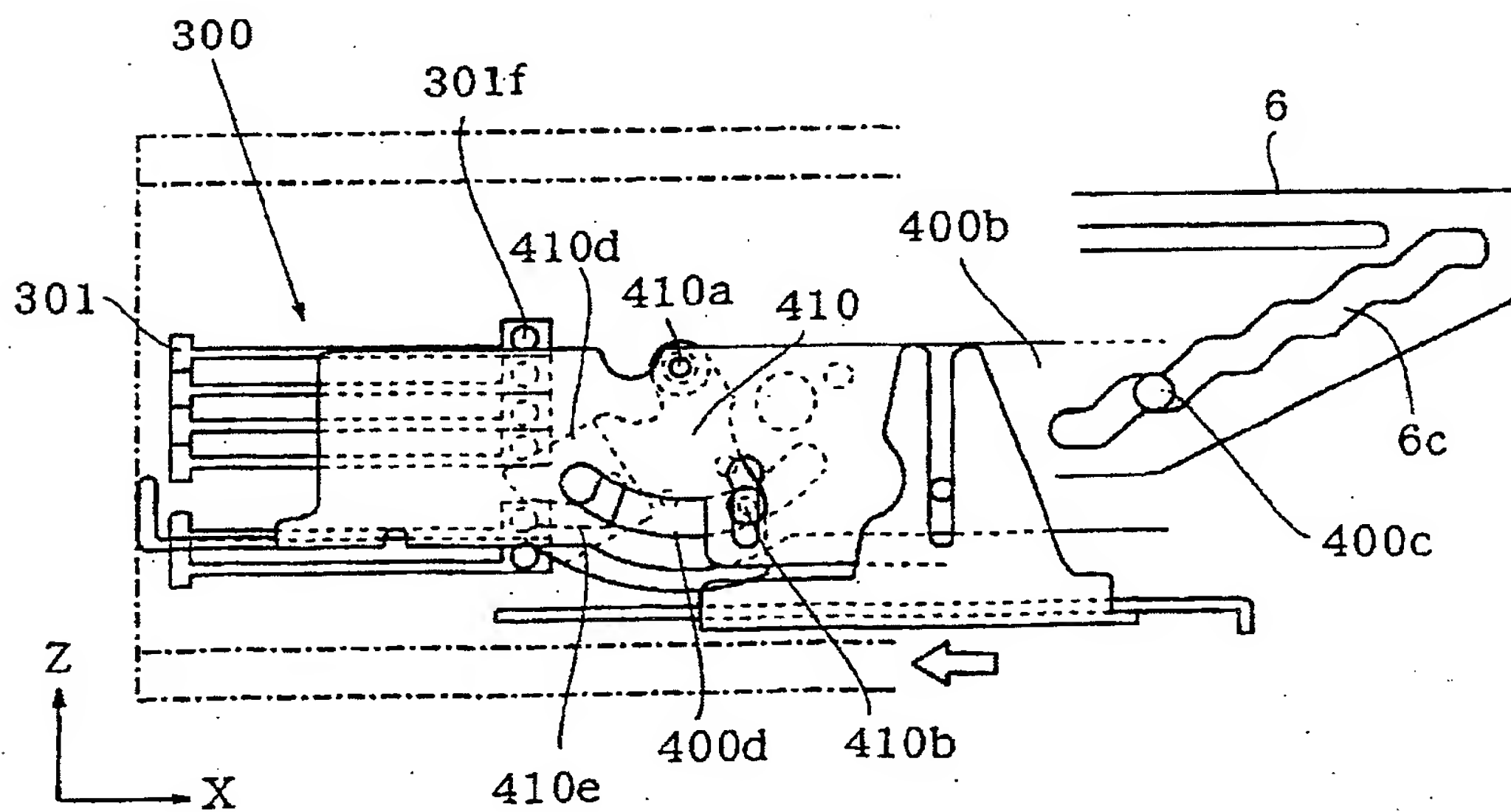




FIG.19

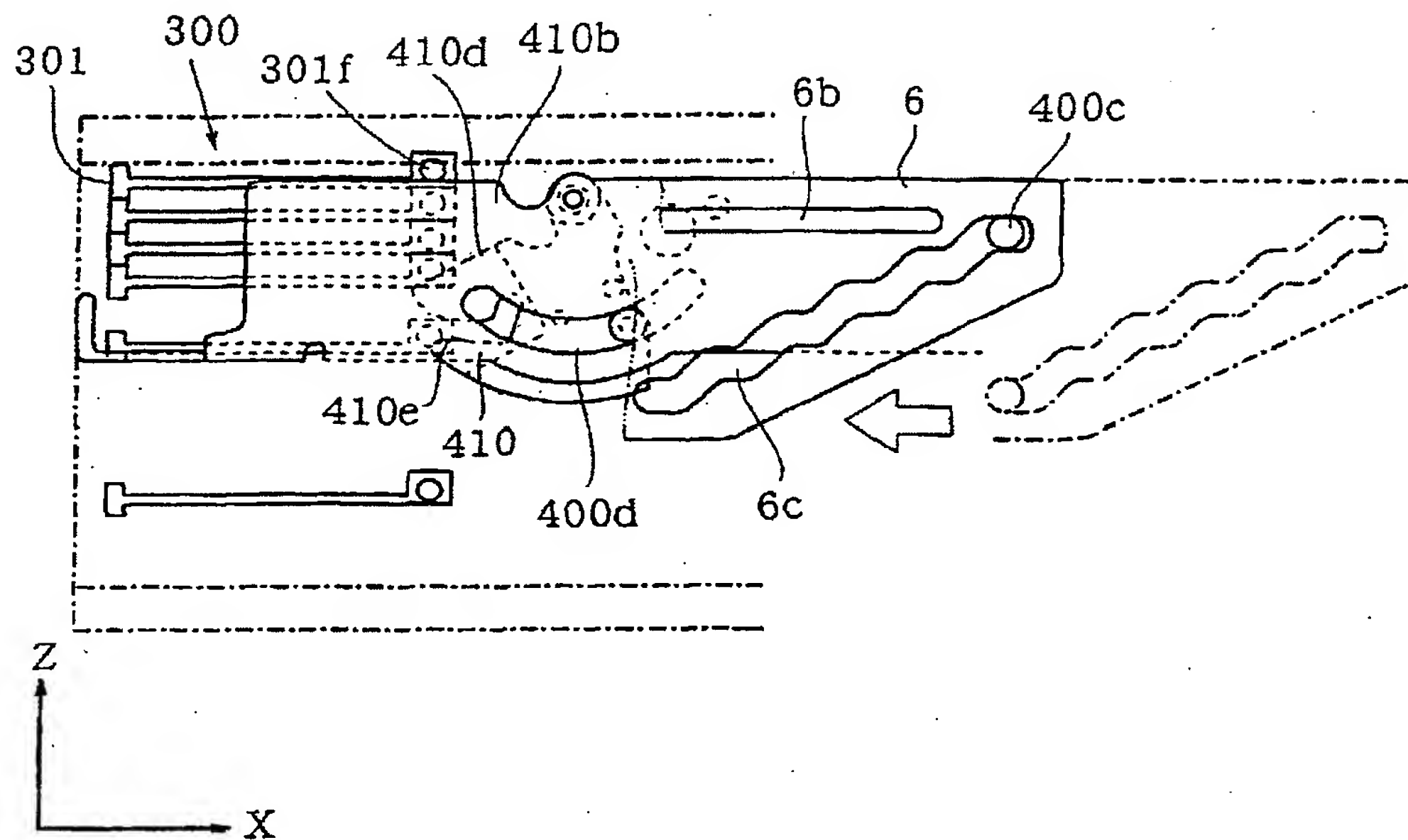


FIG.20

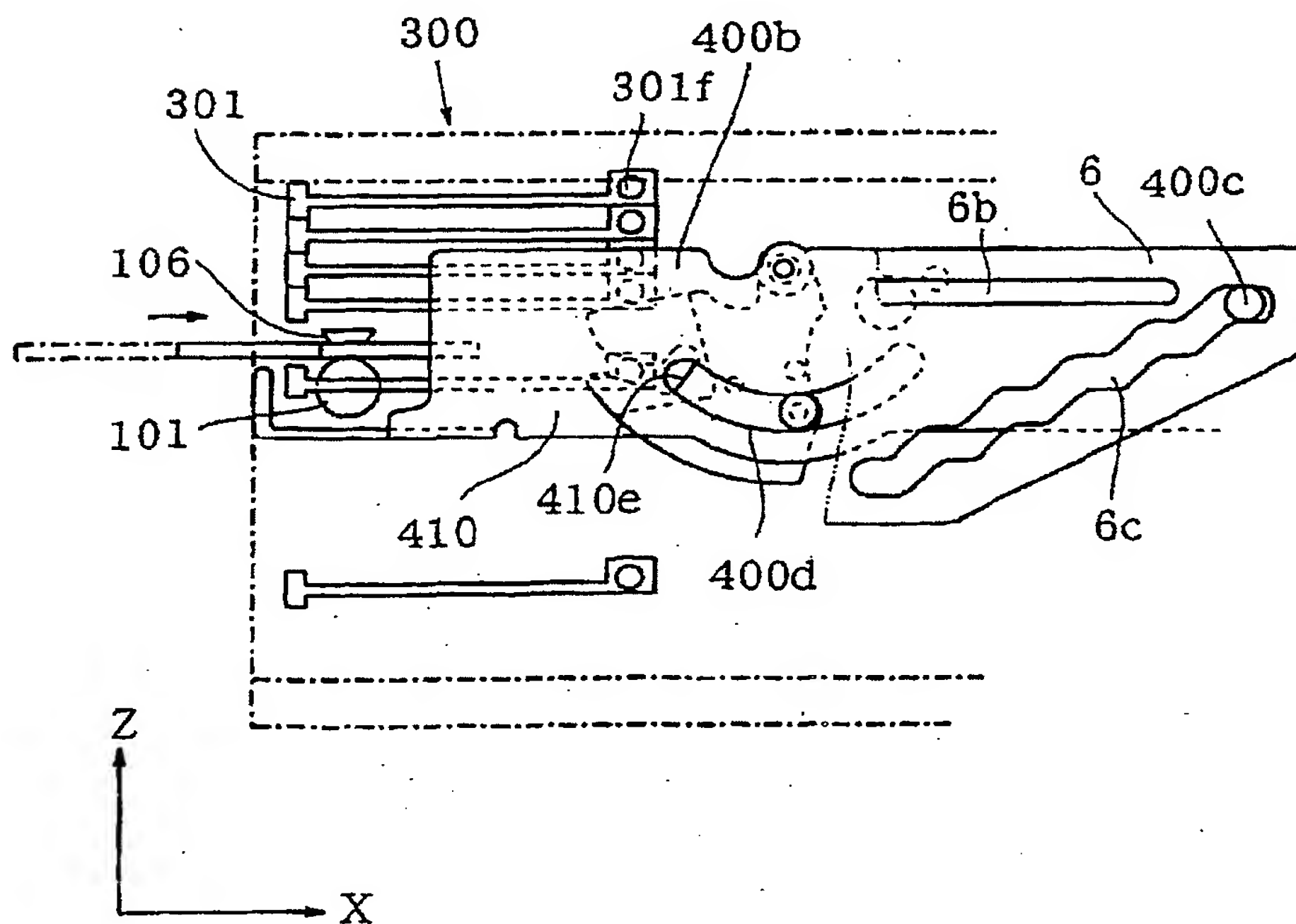


FIG.21

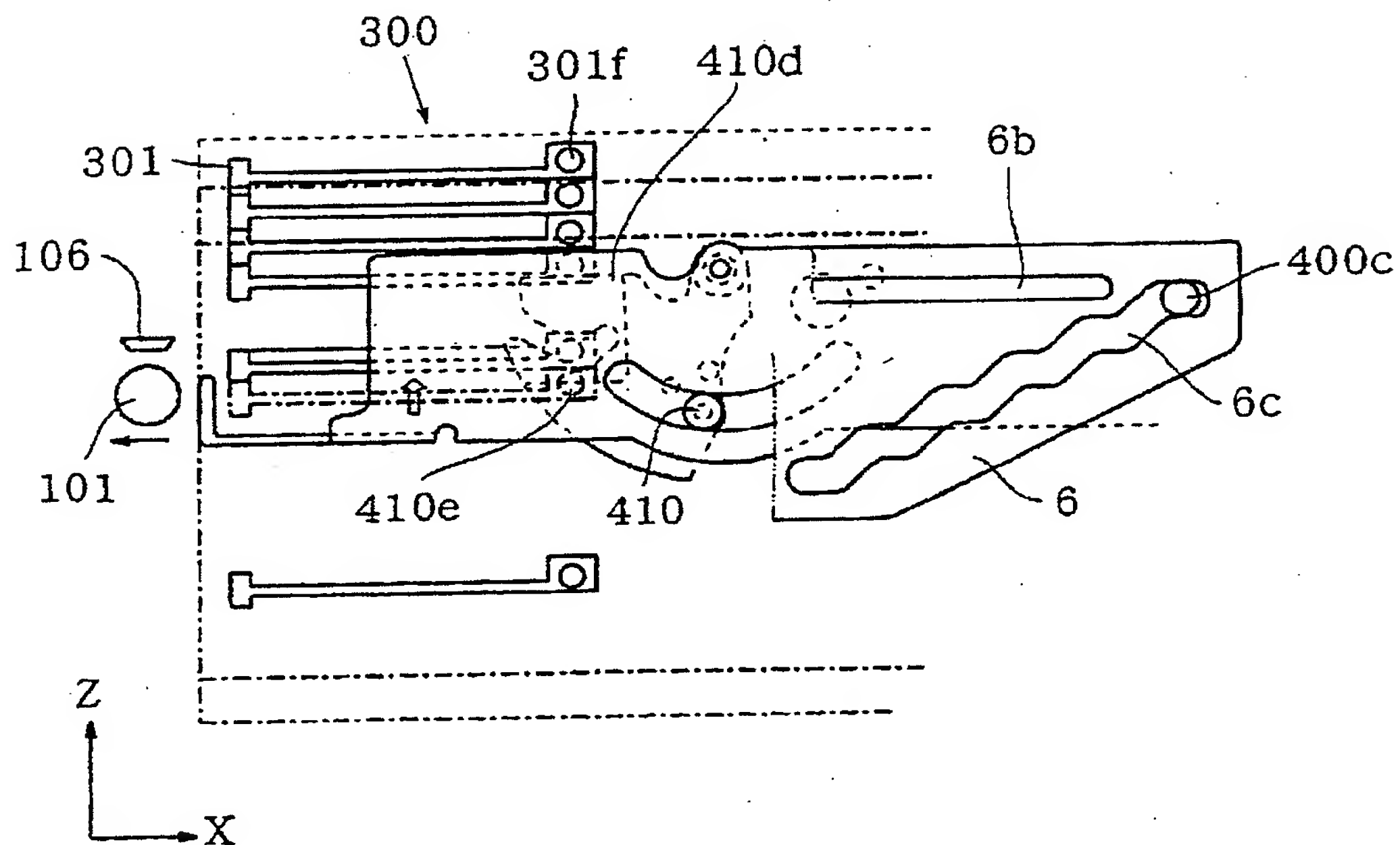


FIG.22

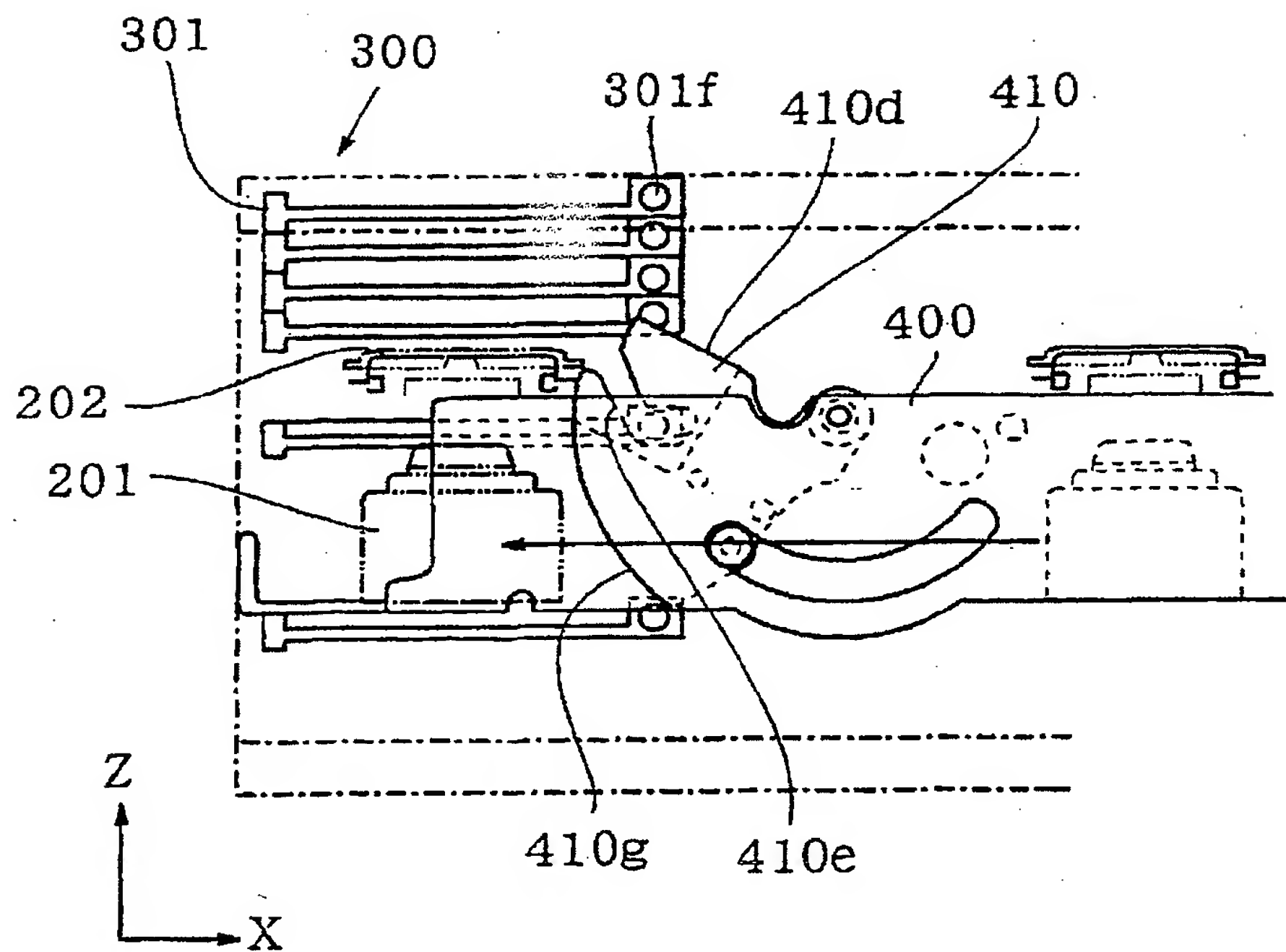


FIG.23

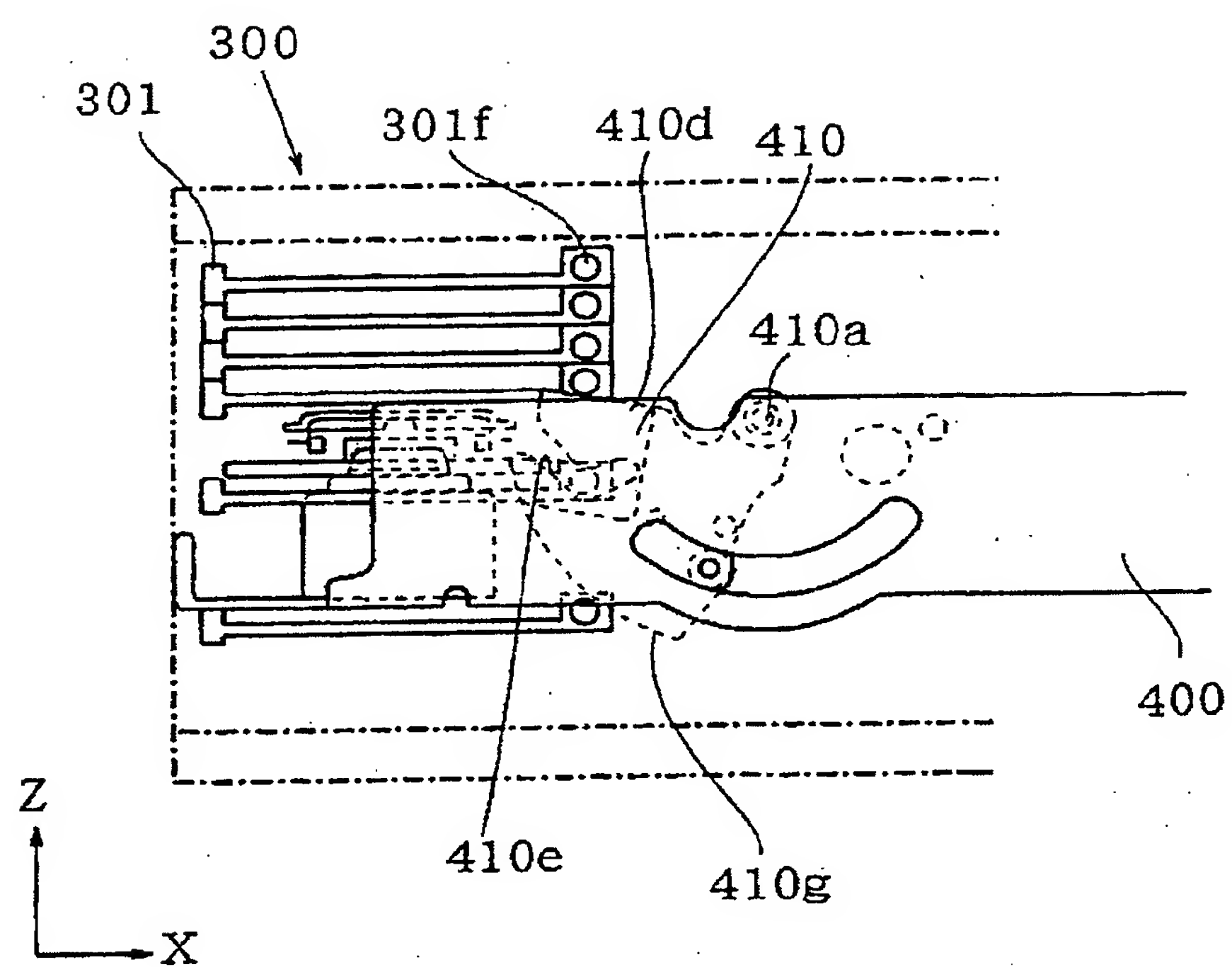




FIG.24 A

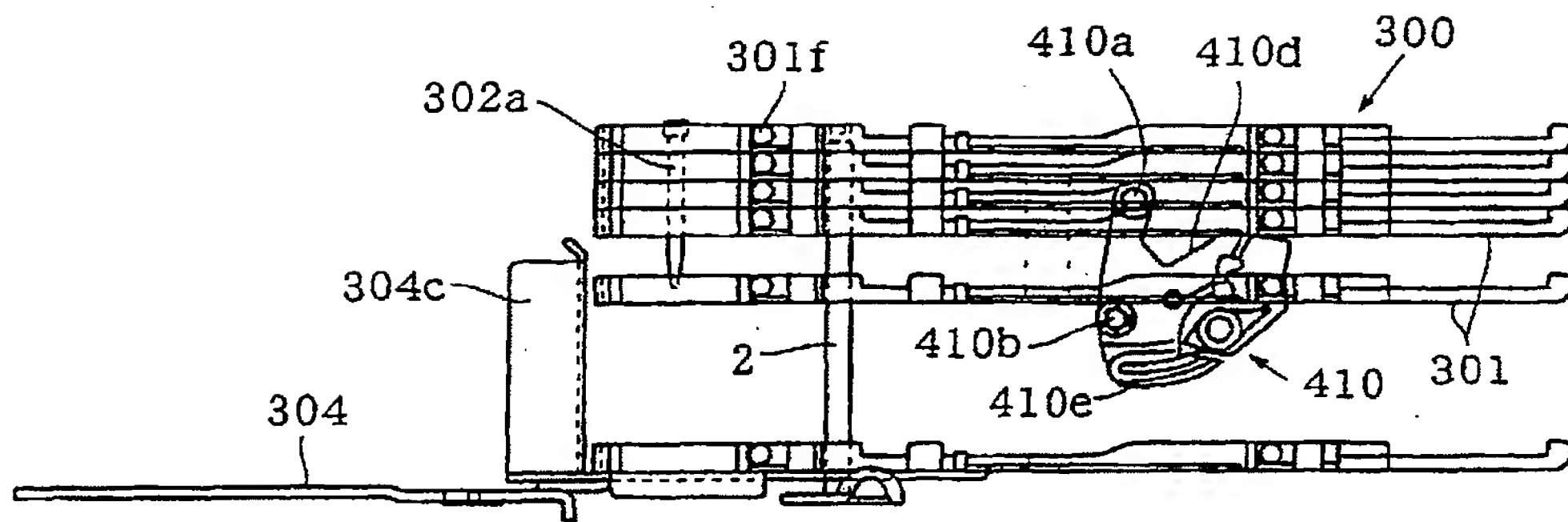


FIG.24 B

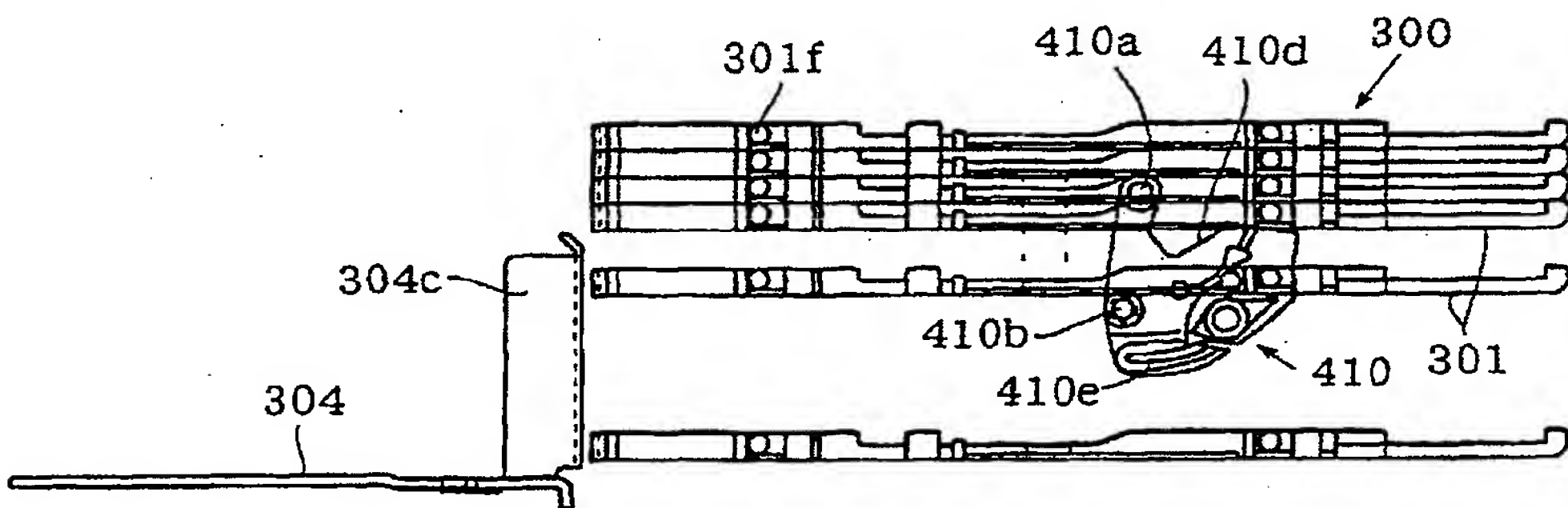
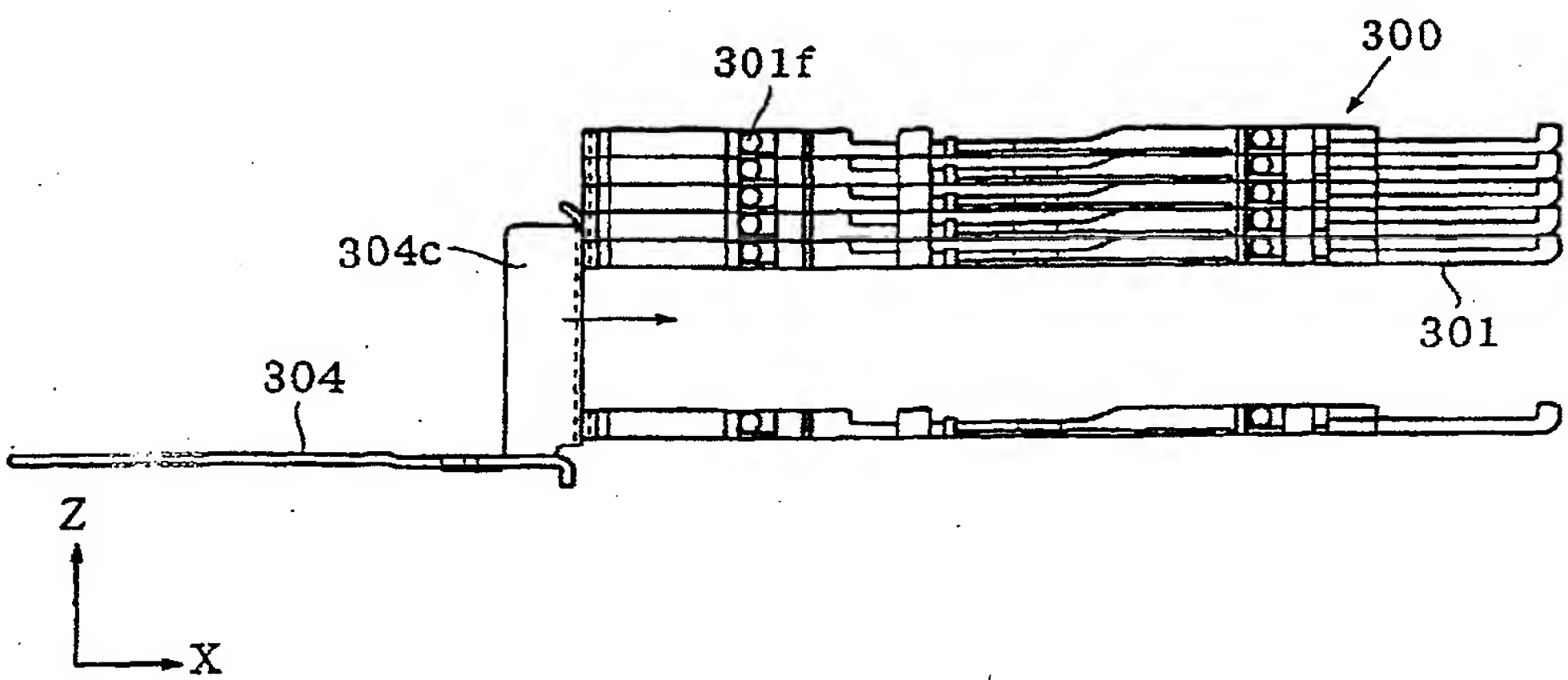


FIG.24 C





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 99 12 3606

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X,P	EP 0 951 017 A (PIONEER ELECTRONIC CORP) 20 October 1999 (1999-10-20)	1-4	G11B17/30
A	* the whole document *	5-7	
	---		
A	US 5 761 185 A (HORIGUCHI HIDEO ET AL) 2 June 1998 (1998-06-02)	1-7	
	* figures 12-14 *		
	-----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			G11B
The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>15 March 2000</b>	Examiner <b>Sozzi, R</b>
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 12 3606

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15-03-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0951017 A	20-10-1999	JP 11306636 A	05-11-1999
US 5761185 A	02-06-1998	JP 8180565 A	12-07-1996

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82